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NOVEMBER 1961

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THE REGULATORS THAT WORKED IN SOLID ICE

Unusually severe winter weather closed in on the farm area served by the Nashville Gas Company, Nashville, Tennessee. Ice formed in a solid mass around three Reliance Type "HPR" Regulators in a district regulator station vault. The regulators were serving a farm tap community and reducing pressure from 600 psi inlet to 15 psi outlet. Service to the district was NEVER INTERRUPTED during these extreme, adverse conditions. The Reliance Type "HPR's" continued to function perfectly during the freeze and after the thaw.

This is another example of the rugged dependability and long service life built into every American® product. Consult your nearest representative for complete details on how American equipment can solve your toughest regulation, measurement and control problems.

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Editor's Notebook

Dear Reader:

A good public relations program is a valuable asset to any business. It is even more important to a utility. By virtue of their exclusive franchises, gas distribution utility companies are monopolies . . . and therefore subject to being suspect by the public despite fact they are rigidly regulated.

To combat the two strikes against them, gas utilities must maintain a 24-hour public relations program designed to improve their public image. Public relations isn't an easy job . . . and too often it receives little acclaim.

Today, the gas utilities' PR departments have another goal for which they can strive . . . one of the annual awards from the A. G. A. It's a real achievement to win one of these awards. That's why we've picked the following news item from the news pages and brought it up front . . . as a salute to the 1961 winners.

Congratulations! — The editors

United Fuel Wins Top Award In A.G.A. PR Contest

United Fuel Gas Company, Charleston, West Virginia, was awarded top honors in the fifth annual A.G.A. Public Relations Achievement competition. The company's winning entry, competing in the Employee Communication category, was based on an effective program of keeping its personnel at all levels fully advised on all new plans and policies. The company's objective is to strengthen information channels through which customers and the general public can get an accurate, clear picture of United Fuel's progress and goals.

Seven other companies also received first-place awards as winners in specified public relations categories. They were: The Columbia Gas System, Inc., New York, press relations; Iowa Power and Light Company, Des Moines, franchise election; Michigan Consolidated Gas Company, Detroit, special event; Northern Illinois Gas Company, Aurora, financial relations; Northern Indiana Public Service Company, Hammond, area development; Philadelphia Gas Works Division, The United Gas Improvement Company, Philadelphia, customer relations; Southern California Gas Company, Los Angeles, community relations.

American Gas Journal®

THE MAGAZINE OF GAS DISTRIBUTION

VOLUME 188 — NOVEMBER 1961 — NUMBER 12

OPERATIONS & MANAGEMENT

LNG For Peak Shaving: An Economic Study 28

Energy wasted in pressure reductions from pipeline to house meter is sufficient to operate small LNG plant and make peak shaving with LNG feasible for many gas utility companies. Part 1 of 2 parts.

Gas Heating Customers Increase 38

More American homes than ever are heating with gas these days; by 1963, over 25,000,000 U. S. homes will heat with gas.

How To Simplify Work 43

It's possible to get more done with less effort, increasing productivity and reducing waste; the key is to train supervisors in work-simplification.

CONSTRUCTION

300-Ft Continuous Bore Helps Cut Main Installation Costs 34

Ingenious new hydraulic boring device helps eliminate paving repair costs; case history shows how Southern Counties Gas Company profits by its use.

Peoples Pipes Seven Towns With Plastic 39

Economics have brought plastic pipe gas distribution systems to seven communities in the states of Iowa, Nebraska, and Minnesota as Peoples Natural Gas engineers seek ways to reduce new system costs.

Distribution Developments 46

News about planned and proposed construction projects in the gas distribution industry.

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MCF.

NEWS HILITES OF THE INDUSTRY

Fishing boat powered by a thermoelectric generator fueled with gas has been successfully operated by Westinghouse engineers. Propane gas was used as fuel, although natural gas would work equally well. The generator, 17-in. long by 7-in. wide, weighs 40 lb. It provides enough electrical power to drive a standard trolling motor to propel the 12-ft fishing boat.

American Gas Company of Omaha, Nebraska, has asked FPC to prevent Milwaukee Gas Light Company from serving communities in Wisconsin in which American Gas had obtained exclusive franchises through its wholly-owned subsidiary, American Gas Company of Wisconsin, Inc. American Gas contends that Milwaukee Gas Light solicited franchises from the communities of Abbotsford, Colby and Unity on the basis that it could begin service quickly, supply requirements from the Michigan-Wisconsin Pipeline Company pipeline, and doesn't need FPC authority for the gas it will sell. American Gas' request to the FPC noted that both Milwaukee Gas Light and Michigan-Wisconsin are subsidiaries of American Natural Gas Company and that the supplying of gas to the communities would be illegal diversion to uncertificated markets of gas allocated by FPC to certificated markets.

Jerome K. Kuykendall, last FPC member still serving under appointment by former President Eisenhower, has resigned effective January 1, 1962. Kuykendall, a Republican, was chairman of the FPC until September 1, when he was succeeded by Joseph C. Swidler, a Kennedy appointee. Kuykendall's term does not expire until June 22, 1962. Kuykendall plans to enter private law practice in Washington, D. C.

Consumption of gas by electric utility power plants reached its highest monthly use on record in August, reports the FPC. The August total of 202.6-billion cu ft was 3.6% above the previous high (August 1960) and 4.3% above the level of July 1961. For the 12-month period ending August 31, 1961, some 1.787-trillion cu ft of natural gas was used for generating electricity. In the same period 178.0-million tons of coal were consumed — a ratio of 1-million cu ft for every ton of coal.

Citizens in Oakwood, Illinois, won't be able to heat their homes and cook their meals with natural gas this winter. An FPC examiner has turned down a request by Central Illinois Electric and Gas Co. to serve the community up to 365,000 cu ft daily because the gas pipeline that would supply the gas doesn't "have sufficient natural gas available" to take on the additional delivery. The examiner, Edward B. Marsh, said the proposed service is necessary and desirable in the public interest, but would compel Midwestern Gas Transmission Company to impair its ability to render adequate service to other present customers.

Contract for a 400-mile helium pipeline, from a government helium extraction plant near Bushton, Kansas, to near Amarillo, Texas, has been awarded to Williams Brothers Company of Tulsa, Oklahoma. The $1,200,000 project will carry raw helium to the Texas site for underground storage in the Cliffside Field near Amarillo.

Merger of Southwest Gas Corporation and Nevada Natural Gas Pipe Line Company, both of Las Vegas, Nevada, has been approved by the boards of both companies. The two firms have the same management and there is considerable joint ownership of the two companies' stock. Southwest Gas is a retail gas distributor, Nevada Natural is a transmission company.

High electric space heating saturation (estimated at 55 to 60%) in the city of Muscle Shoals, Alabama, will keep citizens in the community from enjoying the benefits of natural gas service. FPC examiner E. B. Marsh has recommended denial of a request by the city ordering Alabama-Tennessee Natural Gas Company to supply natural gas to a city-owned distribution system. The examiner said the project was not economically feasible and that there was serious doubt that estimated revenues would produce earnings sufficient to meet interest payments and reduce the debt as the city's proposal contemplated.

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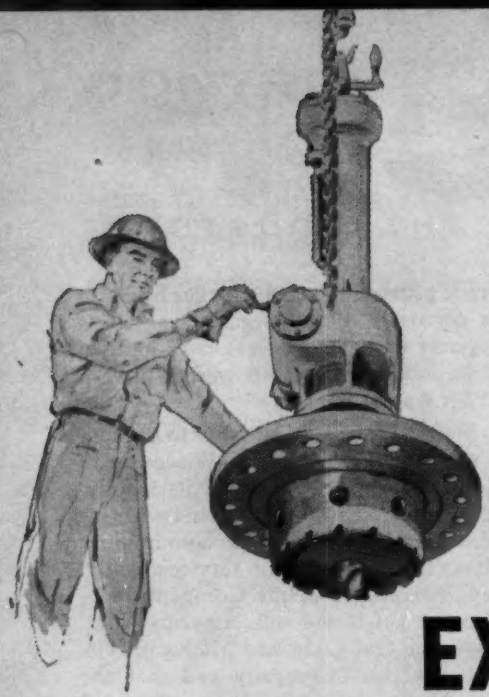
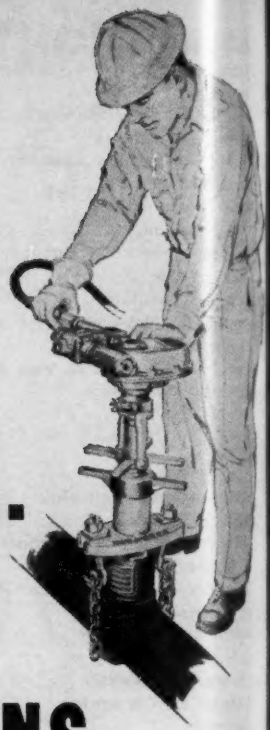




ISOLATE LINES... EXTEND LATERALS ...ADD NEW CONNECTIONS

under pressure!

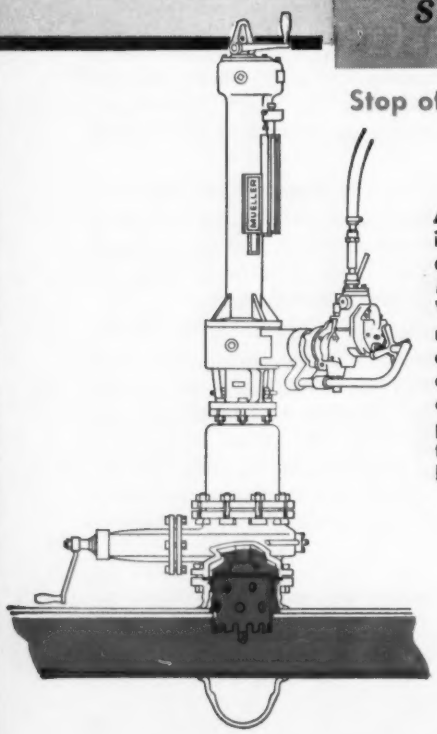
You can make repairs . . . isolate lines that need replacing . . . tie-in new piping . . . install new connections — without interrupting flow. There is no blowing of gas or fluids as you make permanent connections under full pressure and in complete safety.

Mueller® No-Blo® methods and products enable you to work on piping systems whenever needed. A complete line of Mueller fittings, valves and equipment provides an answer to most every problem of working on lines under pressure.

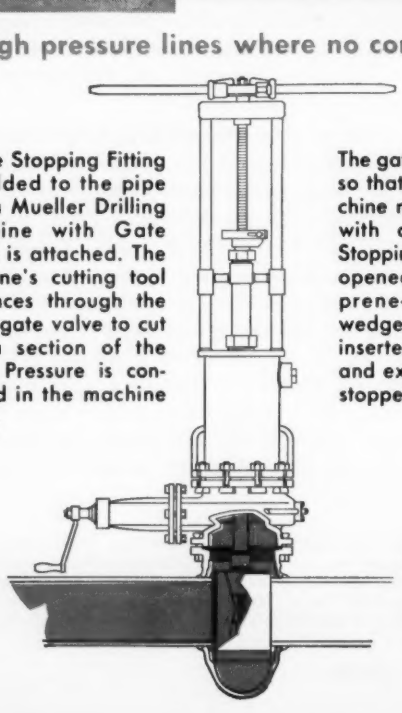
the inside story . . .

Basic steps of Mueller No-Blo Methods are shown briefly in these illustrations.

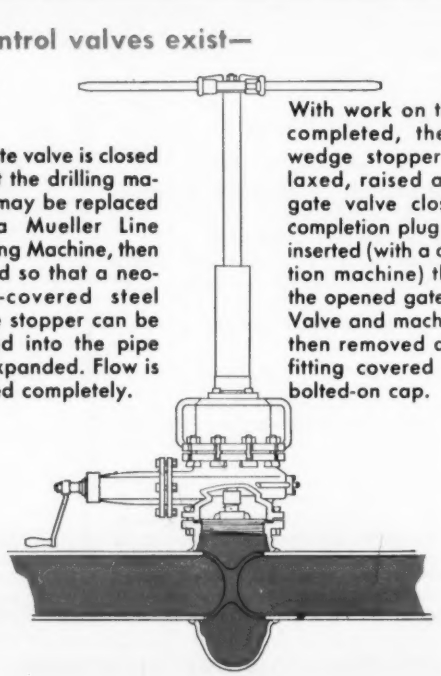
Stop off high pressure lines where no control valves exist—



A Line Stopping Fitting is welded to the pipe and a Mueller Drilling Machine with Gate Valve is attached. The machine's cutting tool advances through the open gate valve to cut out a section of the pipe. Pressure is contained in the machine body.



The gate valve is closed so that the drilling machine may be replaced with a Mueller Line Stopping Machine, then opened so that a neoprene-covered steel wedge stopper can be inserted into the pipe and expanded. Flow is stopped completely.



With work on the line completed, the steel wedge stopper is relaxed, raised and the gate valve closed. A completion plug is then inserted (with a completion machine) through the opened gate valve. Valve and machine are then removed and the fitting covered with a bolted-on cap.

Calendar

OF COMING EVENTS

November

6-10 National Warm Air Heating and Air Conditioning Association, LaSalle Hotel, Chicago, Illinois.
13-15 American Petroleum Institute, annual meeting, Chicago, Illinois.
26-Dec. 1 American Society of Mechanical Engineers, New York, New York.
27-29 A.G.A. Accounting Section Electronics Seminar, Sheraton-Cleveland Hotel, Cleveland, Ohio.
27-Dec. 1 NACE southeast regional conference and Florida general conference short course, Key Biscayne Hotel, Miami, Florida.

December

4-5 Florida Natural Gas Association, Annual Sales Conference, Sarasota, Florida.

January

17 NEGA-Operating Division, Monticello Restaurant, Framingham, Massachusetts.

February

14-16 A.G.A. Home Service Workshop, Milwaukee Inn, Milwaukee, Wisconsin.

March

4-6 Institute of Appliance Manufacturers annual convention, Netherland Hilton, Cincinnati, Ohio.
4-8 ASME Gas Turbine-Process Industries Conference, Shamrock-Hilton Hotel, Houston, Texas.
19-23 NACE 18th annual conference and 1962 corrosion show, Kansas City, Missouri.
22-23 New England Gas Association annual meeting, Statler Hilton, Boston, Massachusetts.
26-28 A.G.A. General Management Section, annual conference, Denver Hilton Hotel, Denver, Colorado.

April

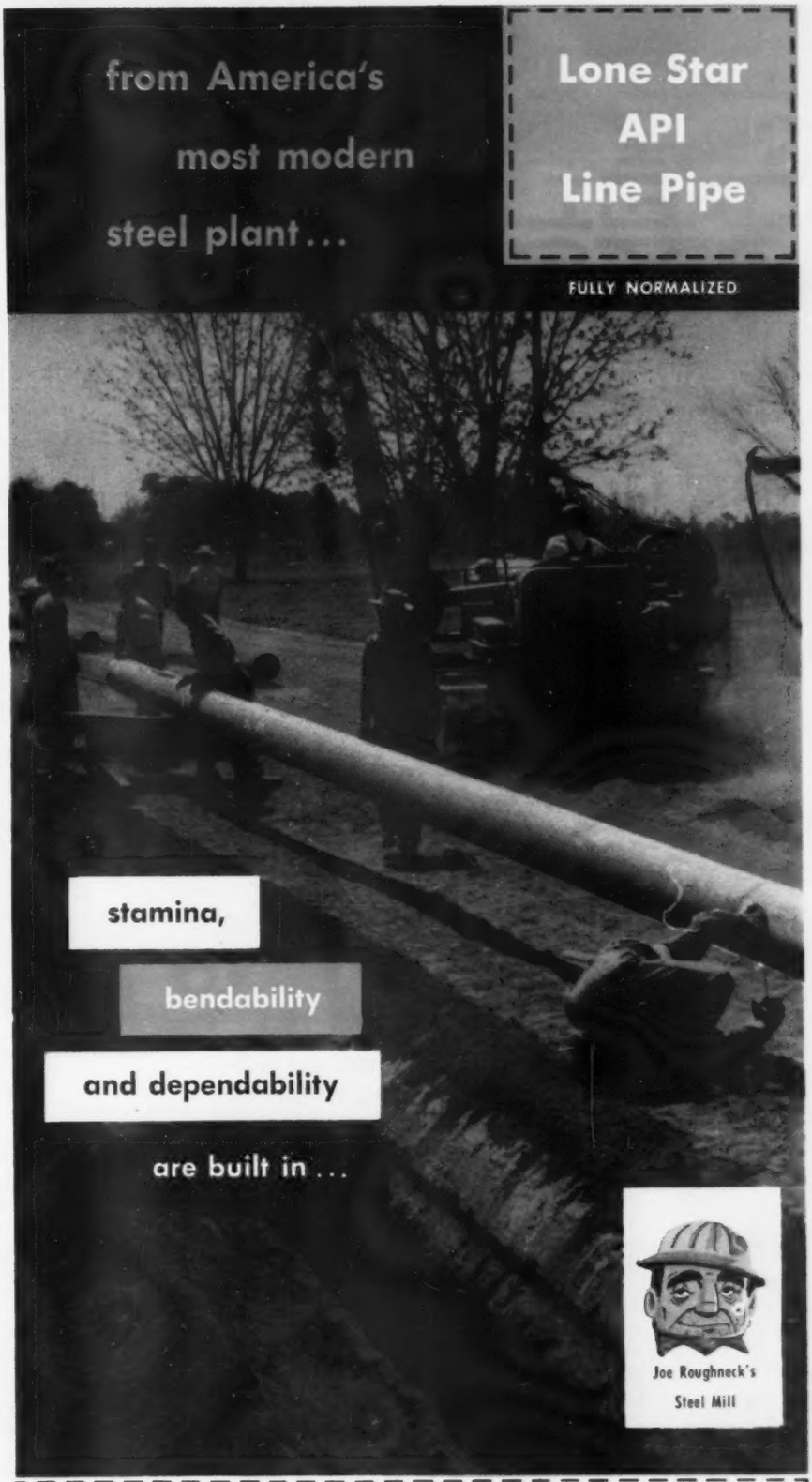
2-4 National Conference of Electric & Gas Utilities Accountants, Bellevue Stratford Hotel, Philadelphia, Pa.
2-5 A.G.A. Distribution Conference, San Francisco, California.
9-10 Mid-West Gas Association, annual meeting, Hotel Radisson, Minneapolis, Minnesota.
10-12 A.G.A. Sales Conference on Industrial and Commercial Gas, Shoreham Hotel, Washington, D. C.
17-19 Southwestern Gas Measurement Short Course, University of Oklahoma, North Campus, Norman, Oklahoma.
23-25 GAMA Annual Meeting, The Greenbrier, White Sulphur Springs, West Virginia.
30-May 2 Southern Gas Association annual convention, Houston, Texas.
30-May 2 A.G.A. Transmission Conference (combined with SGA annual convention), Rice Hotel, Houston, Texas.

May

21-23 A.G.A. Mid-West regional gas sales conference, Edgewater Beach Hotel, Chicago, Illinois.
25-26 Florida Natural Gas Association, annual convention, Robert Meyer Hotel, Jacksonville, Florida.

June

4-5 A.G.A. Manufactured Gas Production Conference, Boston, Mass.



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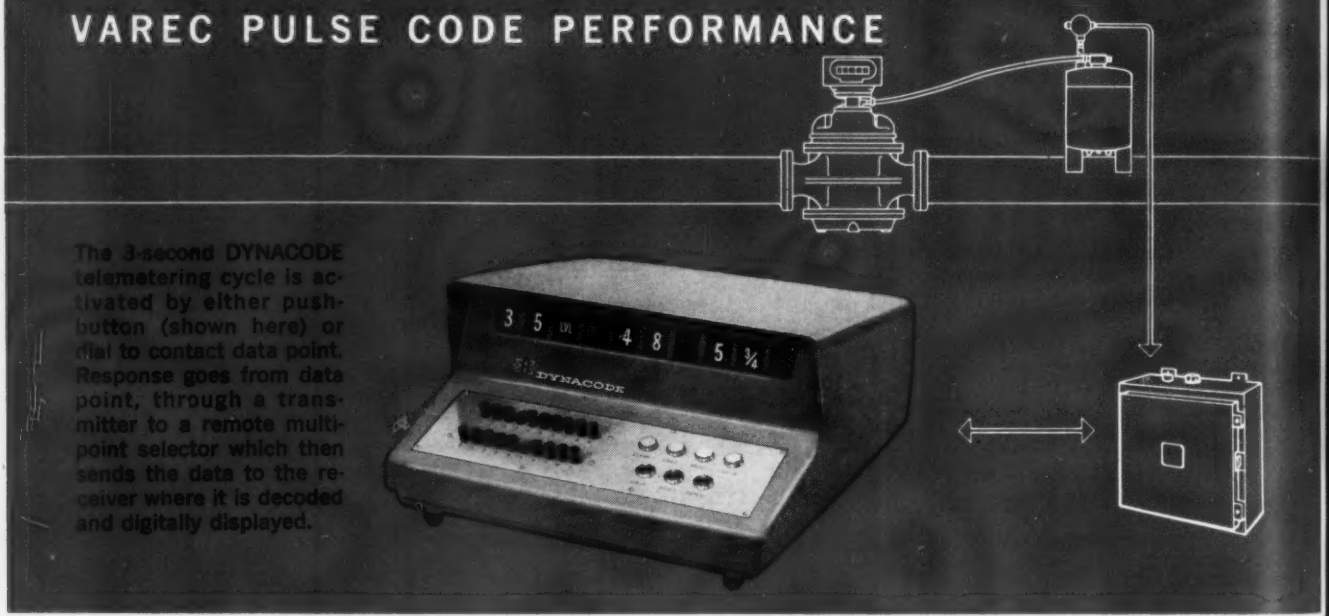
A NEW HIGH-SPEED REMOTE MONITORING SYSTEM BASED ON 6 YEARS OF FIELD PROVEN VAREC PULSE CODE PERFORMANCE



The 3-second DYNACODE telemetering cycle is activated by either push-button (shown here) or dial to contact data point. Response goes from data point, through a transmitter to a remote multi-point selector which then sends the data to the receiver where it is decoded and digitally displayed.

Dynel engineers—utilizing the performance proved concepts of Varec's famous Pulse Code system—have developed the significantly advanced DYNACODE telemetering system for remote readings of liquid level, temperature and P.D.M.

This single-channel, "error-proof" system combines the proven reliability of the basic Varec system with a digital readout time of 3 seconds per point...readout accuracy of 1/16 inch...readout capacity of an unlimited number of points... and readout versatility that permits the system to be tied into a general purpose computer for inventory, billing, and similar functions.

Solid state components are used at key points in the receiver design for longer, maintenance-free life. And DYNACODE, like Varec's Pulse Code, has an instantaneous alarm system without scanning delays.

The high-speed DYNACODE System offers these advantages:

Reliability: Design based on 6 years of performance in scores of pipeline and refinery applications.

Data Display: Illuminated, in-line digital display includes point and function identification, digital data to 6 significant figures and liquid level to 1/16" increments.

Fast Response: data from any given point is gathered and digitally displayed in just 3 seconds.

Flexibility: Designed on building block principle that permits a great variety of system arrangements... DYNACODE is compatible with all standard systems of measurement.

Readout Variety: digital output provides a variety of readouts, including visual display, paper tape, typewriter, etc. Output is compatible for use with general purpose computers.

For complete information, write for Bulletin 301, Dept. PTE-1600-3

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Cast iron pipe provides trouble-free service for years. Inherent ruggedness is the reason: cast iron pipe withstands all the stresses to which underground pipe is normally subjected.

Another feature of strength of cast iron pipe: bottle-tight mechanical joints. These joints put a lock on gas leaks, remain tight during all normal distribution pressures.

The ruggedness lasts for years—in fact, more than a century. Today 63 American gas utilities still use cast iron gas mains that were installed over 100 years ago.

CAST IRON PIPE
THE MARK OF PIPE THAT LASTS OVER 100 YEARS

CAST IRON PIPE RESEARCH ASSOCIATION
Thos. F. Wolfe, Managing Director
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Newsreel

Smoker Named A.G.A. Prexy, Section Officers Elected

E. H. Smoker, president of The United Gas Improvement Company, Philadelphia, was elected president of the American Gas Association at the concluding session of the group's 43rd annual convention. Smoker succeeds Lester T. Potter, president of Lone Star Gas Company, Dallas.

Other officers elected for the coming year include: first vice president, John E. Heyke, president of Brooklyn Union Gas Company; second vice president, Marvin Chandler, president of Northern Illinois Gas Company; and re-elected as treasurer, Charles H. Mann, treasurer of The Columbia Gas System, Inc., New York.

Elected to the board of directors for two-year terms ending in October 1963 are: D. S. Bittinger, president of Washington Gas Light Company; H. A. Eddins, president of Oklahoma Natural Gas Company; Walter T. Lucking, president of Arizona Public Service Company; R. A. Puryear, Jr., president of Alabama Gas Corporation; J. F. Ray, vice president of General Controls Company; R. J. Rutherford, president of Worcester Gas Light Company; Judson S. Sayre, chairman of the board, Norge Sales Corporation; and S. L. Sibley, vice president and general manager, Pacific Gas and Electric Company.

Seven members of the board were re-elected to serve two-year terms. They are: Buell G. Duncan, president of the Piedmont Natural Gas Company; Oakah L. Jones, president of Consumers' Gas Company, Toronto; Ralph T. McElvenny, president of Michigan Consolidated Gas Company; Gerald T. Mullin, president of Minneapolis Gas Company; S. Lloyd Nemeyer, president of Milwaukee Gas Light Company; John W. Partridge, president of The Columbia Gas System, Inc.; and John H. Wimberly, president of Houston Natural Gas Corporation. Potter automatically begins a one-year term as a member of the board.

Wilmer D. Relyea, assistant manager of industrial and commercial sales for Public Service Electric and Gas Company, Newark, New Jersey, was named chairman of the Industrial and Commercial Gas Section. New section vice chairman is Walter E. McWilliams, assistant general sales manager of The Peoples Natural Gas Company, Pittsburgh. Frank J. McLaughlin, vice president of Providence Gas Company, Providence, Rhode Island, was named chairman of the Residential Gas Section. Named as his vice chairman was James J. Condon, assistant vice president of The Peoples Gas Light and Coke Company, Chicago.

William B. Tippy, president of Commonwealth Services, Inc., New York, was named chairman of General Management Section, and Donald B. Beecher, president of Equitable Gas Company, Pittsburgh, was elected vice chairman.

Edwin F. Trunk, chief engineer of Laclede Gas Company, St. Louis, was chosen chairman of the Operating Section. A. B. Lauderbaugh, assistant vice president of The Manufacturers Light and Heat Company, Pittsburgh, was named first vice chairman of Operating Section, and Jay Davis, Jr., vice president of Southern Counties Gas Company of California, Los Angeles, was elected as second vice chairman.

Arthur Skelton, superintendent of the data processing department of The Peoples Gas Light and Coke Company, Chicago, was elected chairman of the Accounting Section. Albert J. Klemmer, auditor of Rochester Gas and Electric Corporation, Rochester, New York, was elected vice chairman.

Columbus Gas Light Joins Century Club

Union Major General James H. Wilson's Raiders almost spoiled the induction ceremony of the city of Columbus, Georgia, into the Century Club, of the Cast Iron Pipe Research Association.

The General isn't aware of the near calamity his raiders caused when they fought the last battle of the War between the States at Columbus in April, 1865. But his troops did destroy the city's records, and with them, the record of the installation of the cast iron gas main, which still serves Columbus to this day.

Officials, however, upon digging up some of the old pipe, determined that the pipe was over 100 years old. The reason: 100 years ago, cast iron pipe was made with a "square-shoulder bell." Columbus' gas mains made with this type of bell-shoulder had to be over 100 years old, authorities agreed.

So the induction ceremony did take place with Don Harrington, representing the Cast Iron Pipe Research Association, presenting the Century Club certificate to Jack M. Averett, Gas Light Company supervisor. The presentation took place on Fifth Avenue, south of 13th Street where workmen dug a section of the old, square-bell pipe, which is thought to have been installed in 1854. The oldest piping still in use was used then to connect the old gas lamps that illuminated downtown Columbus.

The Century Club of the Cast Iron Pipe Research Association includes communities across the nation that still use water or gas mains made of cast iron laid 100 years ago, or more. To date, 66 gas utilities are Century Club members.

Jack M. Averett (right), Gas Light Company of Columbus supervisor, and Don Harrington, Southeastern regional director of the Cast Iron Pipe Research Association, look over a section of cast iron pipe in use in Columbus more than 100 years.

Ross Formally Sworn In As New FPCommissioner

Charles R. Ross, former Vermont Public Service Commission chairman, has been sworn in as a member of the F.P.C. Ross is the fourth Kennedy appointee to take a seat on the five-member commission since early summer. A Republican, he succeeds the late Frederick Steuck.

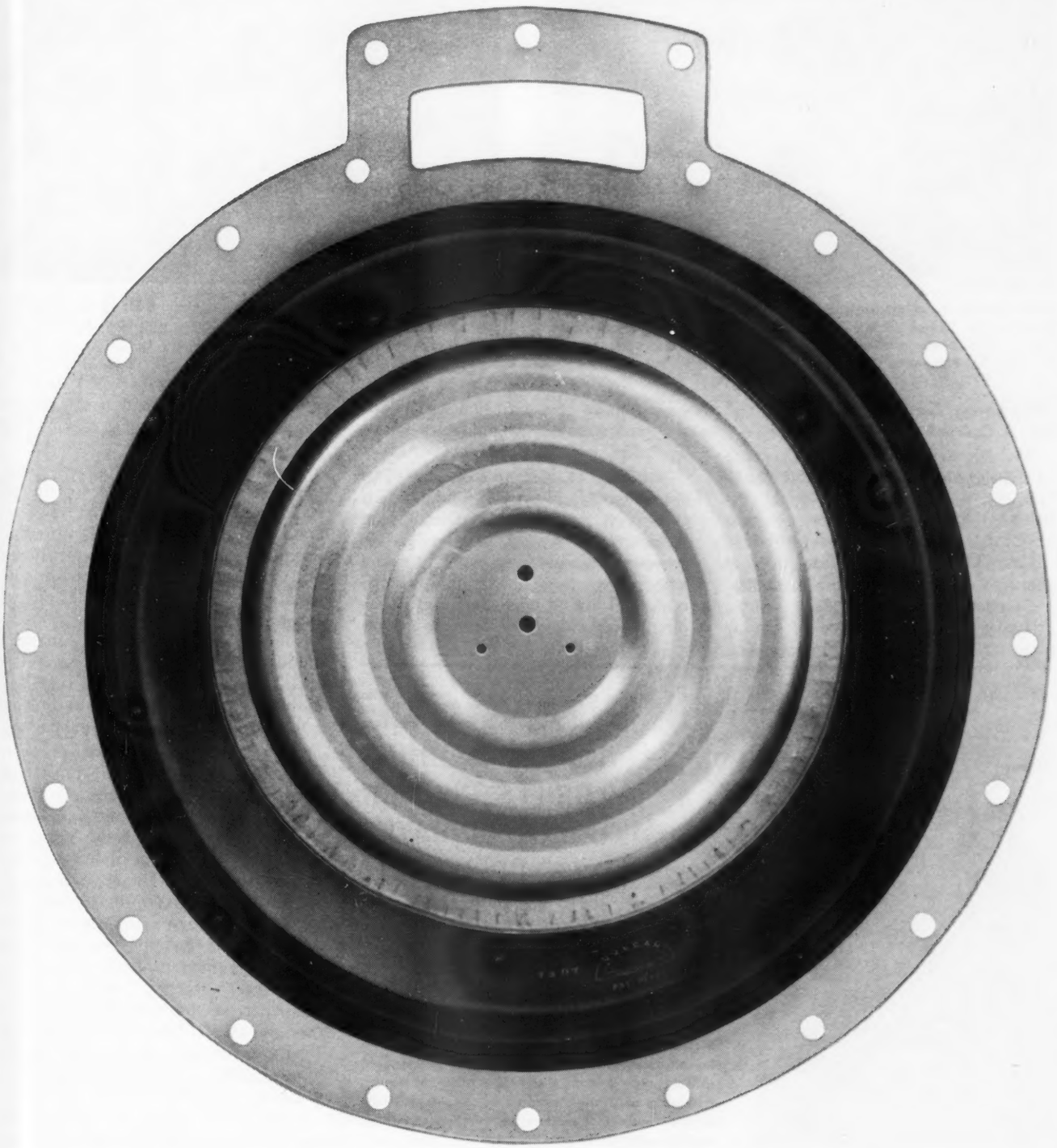
Industrial Gas School Breaks Attendance Records

A.G.A.'s 8th Industrial Gas School, held in Philadelphia during September, rang up a record breaking attendance of nearly 200 students from 29 states, with 25 registered from Canada.

Redesigned program of learning marked trend away from usual classroom lectures. Emphasis was on plant visitations and field trips. Final wind-up was a sales seminar. Students were divided into 12 groups, functioning competitively to make and judge presentations.

Copies of the school's lectures are available from the American Gas Association Order Department at $5.00 each.

REEVES VULCAN SYNTHETIC DIAPHRAGMS



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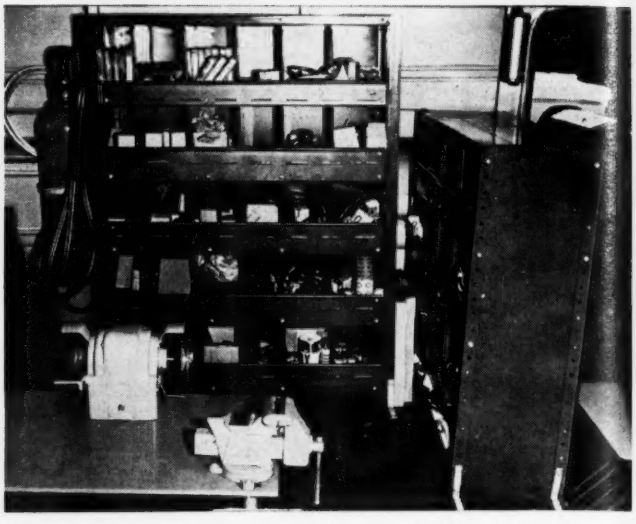
REEVES

VULCAN

Reeves Brothers, Inc., Vulcan Division, 1071 Avenue of the Americas, New York City, N. Y.

Twenty-four hour appliance repair service is a new feature of Peoples Gas System of Florida. Both East and West Coast divisions utilize these shops on wheels that can do any kind of repair or overhaul job for a customer right on the premises.



Interior view of Peoples Gas 24-hour-repair truck shows bins containing most commonly used repair parts; work bench and tools, welding equipment, and tool kits.

Stephens, Cramer Head List Of A.G.A. Awards Winners

W. R. Stephens, chairman of the board and president of Arkansas Louisiana Gas Company, Little Rock, was awarded the gas industry's highest honor, the Distinguished Service Award of the American Gas Association, at the A.G.A. annual meeting in Dallas.

Stephens was cited as the industry's "pioneer in the resurgence of gas air conditioning and gas lighting" when the presentation was made by Lester T. Potter, A.G.A. president.

Anthony H. Cramer, executive assistant for Michigan Consolidated Gas Company, received the Distribution Achievement Award. The award is presented annually to an individual who has made an outstanding contribution to the science and art of gas distribution during the year, or an outstanding contribution that has gained gas industry acceptance during the past five years.

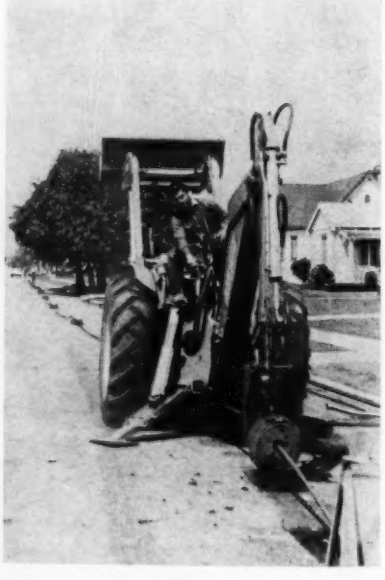
Cramer has been vice chairman of the Distribution Subgroup for the revision of American Standard B31.8 on Gas Transmission and Distribution Piping Systems since it was organized in 1952, and he also headed the editorial group responsible for the material as presented in B31.8. Since 1957, he has been chairman of the American Standards Association Subcommittee B31.2 pertaining to gas fuel lines and industrial installations and has directed a thorough revision of this standard.

Demosthenes Menegakis, former staff engineer for The Brooklyn Union Gas Company, now associated with the Corporation for Economic and Industrial Research, Inc., New York, received the Beal Medal of the A.G.A.'s Operating Section. The coveted medal, granted for authorship of an outstanding technical paper presented before an A. G. A. meeting has been presented only once since 1956.

Menegakis received the award for his paper on "Experimental Investigation of Flow Characteristics of Low Pressure Services" read at the Association's 1961 Distribution-Production Conference in Philadelphia.

Edmund L. Spanagel, manager of the commercial and industrial sales department of Rochester Gas and Electric Corporation, Rochester, New York, received the Industrial-Commercial Achievement Award.

A.G.A. Operating Section Awards of Merit were presented to: Willard E. Lebo, production staff engineer, Public Service Electric and Gas Company; Frank P. Mueller, assistant director of safety, Peoples Gas Light and Coke Company; J. Louis Oberseider, gas supply engineer, Pacific Lighting Gas



HYDRA-MOLE

BORING MACHINE DRILLS PIPE OR TUBING AT RATES UP TO ONE FOOT PER SECOND UNDER ROADS . . . SIDEWALKS . . . LAWNS

In use now for over two years, the Hydra-Mole is continuing to provide substantial savings in drilling pipe under streets and other obstacles. Requiring only one operator, it can replace two to four men and produce up to three times as much work.

Check these features . . .

LENGTH CAPACITY — no limit established, longest continuous bore to date, 500 ft. See actual photograph above.

SPEED — bores up to one foot per second horizontally.

ROTATION — 50 to 300 RPM
POWER — self-contained hydraulic system provides torque up to 7 tons.

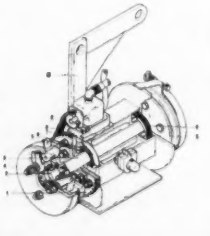
SIZE CAPACITY — handles ¾" to 3" dia. drill rod, pipe, hex rod, etc., takes up to 18" pipe using reaming and packing procedure.

SOIL CONDITIONS — operates wet or dry in most types of soil.

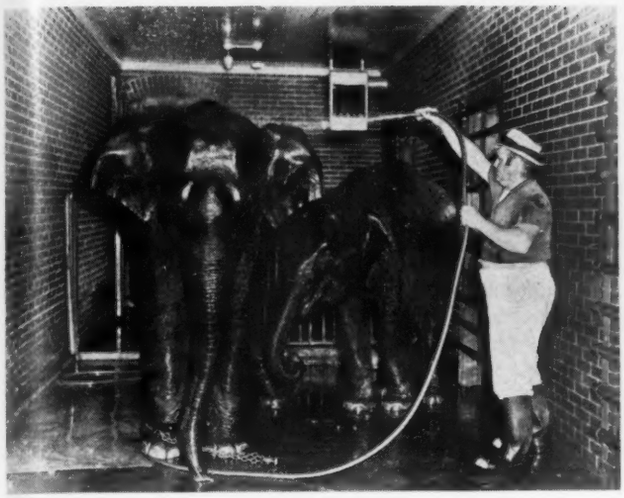
MOUNTING — mounts in minutes on backhoe, gradall or similar device.

OPERATION — operates in any position; can be submerged in mud or water; works from ground surface or 18" wide slot at any depth.

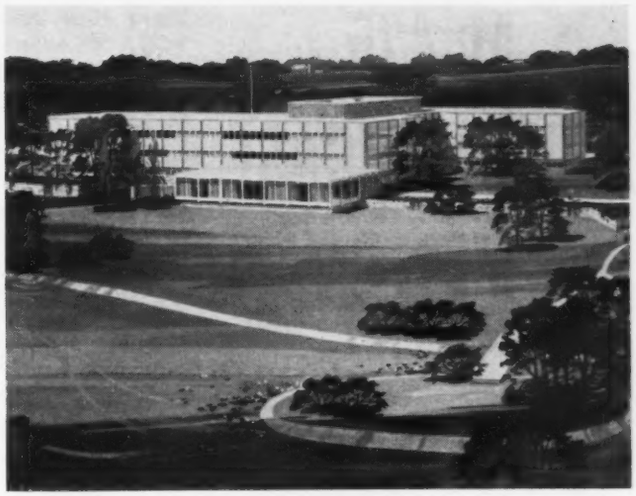
VERSATILITY — bores with extra heavy steel pipe but will place any type in ground.



HYDRA-SERV, INC.
562 Glenoaks Blvd. San Fernando, Calif. EM 1-3444



Fifty gallons of tepid (80 F) water per elephant is the daily bath requirement of two elephants in residence at Grant's Farm Zoo, open to the public at the 281-acre St. Louis estate of August A. Busch, Jr., president of Anheuser-Busch and the St. Louis Cardinals. They are Tessie (left), age 11 and weight 5500 lb, and Peggy, age 8 and weight 3500 lb, both ready to be admired after each morning hose-down by Frank Parko, animal trainer and zoo keeper. Hot water, supplied by a Ruud Sanimaster gas water heater, is also used to mix food for animals and to launder horse sheets and towels.



Official groundbreaking ceremonies were held recently for Northern Illinois Gas Company's new general office building northeast of Aurora. Completion is scheduled for early 1963. The $2 million building will be a three-story structure, providing about 125,000 sq ft of office space, located on a 112-acre site. A new electronic billing and data processing system is to be installed in the building to handle the accounting for NI-Gas' 735,000 customers. A natural gas turbine-generator system will provide all electricity, heating and cooling used in the building, including energy for high frequency lighting.

Supply Company; Charles D. Taft, general superintendent, The Gas Service Company; and Raymond W. Todd, vice president and executive engineer, Pacific Lighting Gas Supply Company.

The Section's Award of Merit also was presented posthumously to Robert W. Alexander of Cincinnati Electric and Gas Company.

Winners of A.G.A. Home Service Achievement Awards include Miss Lucile Boettcher, home service director of Laclede Gas Company; Miss Marie O'Brien, home service director of Providence Gas Company; Miss Carol L. Sellow, home service consultant with the Boston Gas Company; Mrs. Muriel K. Miura, home economist, Honolulu Gas Company, Ltd.; and Mrs. Evalyn Vaughan, division home economist, Pacific Gas and Electric Company.

A.G.A.'s Order of Accounting Merit was presented to: E. M. Alt, assistant treasurer, Northern Indiana Public Service Company; Francis T. Hager, manager of collection and meter reading division, Philadelphia Gas Works; Malcolm S. Lonon, treasurer, Consolidated Natural Gas Company; Harry F. Luther, assistant treasurer, North Shore Gas Company, Illinois; Charles D. Otcasek, supervisor, machine accounting development, East Ohio Gas Company; and Arthur Skelton, general superintendent, accounts division, Peoples Gas Light and Coke Company.

Thermoelectric Control For Refrigerator Demonstrated

A thermoelectric control used on a refrigerator for the first time was demonstrated during the A.G.A. annual convention in Dallas. In the control, a thermoelectric element is heated by the pilot flame of the refrigerator burner.

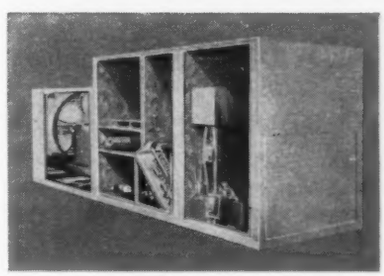
A. O. Smith Reaches Milestone

Six-millionth water heater has been produced by A. O. Smith Corporation, representing greatest volume production by any single manufacturer in the industry during the corporation's 20-year life span. Production capacity has been upped to more than 66,000 water heaters monthly at the Kankakee plant and an added production capacity of more than 10,000 at Newark, California.

gascool announces the FIRST ALL GAS HEATING AND COOLING COMBINATION now in service

MODELS AVAILABLE IN 5 TO 10 TON CAPACITIES

The new gascool roof-mounted unit heats with gas—cools with gas. Ductwork expense is eliminated — no floor space is required. Quick, easy installation and low maintenance costs combine to make a serviceable, economical unit. Individual roof-mounted units give insurance against total breakdown. And—gascool can provide you with a unit for cooling only, if desired.



gascool exceeds industry standards for quality, cooling, and dependability. And gascool is economical too — giving a savings of up to 61% in operating costs.

gascool's complete line includes models in 3 ton to 15 ton capacities with built in air cooled condensers, water cooled condensers, or remote type air cooled condensers; and roof mounted models with heating and cooling combination or cooling only in 5 to 10 ton capacities.

These features, plus others, make gascool the best buy.

QUALITY ECONOMY DEPENDABILITY

All are found in a gascool Gas Powered Air Conditioning System

gascool

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Division of Aero-Test Equipment Co., Inc.

AL-425 ALUMINUMCASE METER

For Small Industrial and Commercial Loads

- Compact and light weight – only 18 lbs.–savings in shipping, handling and setting costs.
- Available with Temperature Compensation.
- Die-cast, one-piece aluminum alloy body – high resistance to impact damage–steel connection threads eliminate galling.
- Bellows-type Duramic diaphragms for all fuel gas services.
- Rated capacity of 425 cfh at ½-inch w.c. differential with 0.64 sp. gr. gas–10 psi maximum working pressure–1¼-in. MC connections.
- Longest service life at lowest cost per meter per year of service.

See Bulletin 317 for details.

AMERICAN METER COMPANY

Sales Offices in Principal Cities

Next Half-Decade Vital, PCGA Convention Told

The next five years will be the most important period in the history of the gas industry, delegates to the 68th Pacific Coast Gas Association were told by W. G. Hamilton, Jr., president of GAMA. "The public has seen many scientific breakthroughs and achievements and will continue to demand even more modern design and automatic performance in appliances," Hamilton said. "This, plus continuing competition and growing markets through population expansion and increased home building, are the challenges facing the industry in the next five years." He called the next half-decade "pivotal."

A possible new method of transporting natural gas was discussed by John R. Fraser, manager of natural gas and gasoline for Union Oil Company. The gas reserves to which Fraser referred are in Alaska. Union Oil discovered the reserves in 1959. Fraser dwelled upon the technical aspects of shipping the liquefied natural gas from Alaska to California.

Other gas industry speakers on the program included: George F. Senner, vice chairman of the Arizona Corporation Commission, who talked on gas rate-setting procedures in Arizona; John F. Childs, vice president of Irving Trust Company, New York, who discussed the planning of a capital structure for gas distribution companies and future financing in growth areas; and Howard Boyd, president of El Paso Natural Gas Company, who told of the current and future status of natural gas supplies for the West.

W. J. Bailey, president of Day and Night Manufacturing Company and Payne Company, La Puente, California, was elected president of PCGA for 1961-62. Bailey formerly was first vice president of the group. He received his gavel from H. G. Dillen, president of San Diego Gas and Electric Company, outgoing PCGA president.

S. L. Sibley, vice president and general manager of Pacific Gas and Electric Company, San Francisco, was elected first vice president; and Alan R. Bailey, executive vice president, Southern Counties Gas Company, Los Angeles, was named second vice president; and L. A. Coughlan, comptroller for Pacific Gas and Electric, was elected treasurer. Walter S. Lee, president of Major Controls Company, Corona, California, was re-elected chairman of the Manufacturers Section, and Frank Breckenridge, executive vice president and general manager of O'Keefe and Merritt Company, Los Angeles, was re-elected vice-chairman. Both will also serve as GAMA directors.

Good old gas lights proved a life-saver at a recent variety show of the Pomona, California, Masonic Lodge. Harold M. Christensen (left), distribution supervisor of Southern Counties Gas Company's Eastern division (and Worshipful Master of the lodge), and Leo Welch, sales representative for the gas firm, inspect the gas fixtures, still connected after many years. They were pressed into service when the electricity failed.

Gas Lights Save Show When "Reddy" Proves Undependable

Natural gas has proved its dependability again, this time at the annual festival of the Masonic Lodge in Pomona, California. As the 350 ticket holders were being seated for the lodge's variety show, all the electric lights in the building suddenly went out. After a few minutes of bedlam, a lodge member remembered that the old, original gas light fixtures on the auditorium walls were still connected. The gas lamps were quickly lit and the audience seated in an orderly manner. The show started on time, with the auditorium illuminated by the soft glow of gas lights.

SGA Wins Association Award

Second place award for outstanding printed convention materials went to Southern Gas Association at the American Society of Association Executives' "Idea Fair" held in Dallas recently. The S.G.A. entry consisted of printed materials developed for the annual convention held last spring in New Orleans, including the convention programs, bulletins, badges, directory, and invitations to entertainment activities.

Industry Safety Record Improves

Disabling injuries in the gas industry dropped to a record low in the second quarter of 1961, according to a national survey by A.G.A. A sampling of 83 representative companies showed a 14.4% decrease. The frequency rate in the second quarter was 5.35 disabling injuries per million manhours, compared with 6.25 a year earlier.

The severity rate of 444 days lost per million manhours represented a drop of 16.1% from 529 days lost in the second quarter of 1960.

Men At Work

New sales manager for all distribution operations of United Gas Corporation is **Laurie P. Jones,** who has been Houston division sales manager for the last four years. He will make his headquarters in Shreveport, La. **John C. Flanagan,** vice president and general manager of United's Texas distribution division retired September 1, following 32 years of service with the company.

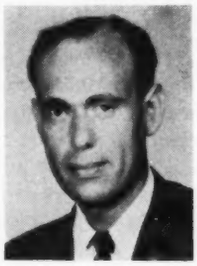
J. C. Flanagan

L. M. Hammer

Leonard M. Hammer has been named sales promotion manager for Hardwick Stove Company, Cleveland, Tennessee. Hammer joined Hardwick after three years with the American Gas Association in New York City, first as promotion manager and later as manager of the Gold Star Gas Appliance Program.

Donald E. Shively has been named division manager of Southern Counties Gas Company's Eastern division, headquartered in Pomona. He succeeds **Homer R. Mead,** Eastern division manager for more than 25 years, who retired August 31.

H. L. Pratt



E. G. Warshafsky

T. H. Rennell Jr.

A. W. Farley

New England Electric System's Gas Division has elevated four men. **Harold L. Pratt** has been named assistant to the general superintendent of the Division's North Shore Gas Company in Salem. **Ernest G. Warshafsky** has been appointed distribution engineer in the Gas Division, replacing Pratt. **Thomas H. Rennell Jr.,** succeeds **Herbert C. Jones,** retired, as chief gas engineer; **Arthur W. Farley** has been named engineer.

Daniel C. Gillespie, Columbia Gas System Service Corporation, has been named "Systems Man of the Year — 1961" by the Systems and Procedures Association of America. Gillespie is director of data processing for Columbia Gas System with headquarters in Columbus, Ohio. His present assignment is the planning for and installation of an integrated data processing system for his company, involving the use of medium and large scale computers, along with data transmission by wire, microwave, etc.

S. D. Whiteman, president of the Kansas-Nebraska Natural Gas Company since 1946, has been named chairman of the board and chief executive officer; **Thomas Creigh Jr.,** vice president in charge of production, transmission and gas supply since 1951, has been appointed president and principal operating officer; **Frank Flagg,** who formerly held the discontinued office of executive vice president, was named financial vice president.

Three new vice presidents also named include **Frank Soldan,** general sales manager, now vice president in charge of merchandising; **Fred Steffens,** secretary and controller, and **Stephen D. Ford Jr.,** chief engineer, now vice president in charge of production and gas supply. Other management promotions include **James Asbury,** senior engineer who replaces Ford as chief engineer, and **John Ashburn,** engineer, named senior engineer.

Robert E. Artrup has been named assistant district plant engineer for the Ohio Fuel Gas Company in Norwalk, Ohio. **G. Ninde Lawson,** accounting supervisor, has been named a co-ordinator of customers accounting in Ohio Fuel's general offices in Columbus.

Robert G. Bashore has been appointed manager of area development for The Peoples Natural Gas Company, Pittsburgh, Pennsylvania. He succeeds **Charles L. Yost,** who retired August 1. **Lurting K. Beatty** has been named commercial air conditioning sales manager for Peoples Natural.

R. Kenneth Fairchild has been appointed research and production engineer at Lancaster Meter Parts Company. He was formerly with a gas meter manufacturer where he served as research and development engineer.

R. K. Fairchild

K. R. Daniel

Kenneth R. Daniel has been elected executive vice president of the American Cast Iron Pipe Company. Previous to this promotion, he held the position of vice president in charge of engineering and purchases.

Vermeer 4-T POW-R-DITCHER

Rugged, Low Cost Ditcher Digs 6"-14" Wide, 4½' Deep

This highly maneuverable 4T POW-R-DITCHER is only 46" wide . . . fast . . . and can handle most ditching jobs at a fraction of the cost of larger, more expensive units. The finest ditcher buy for low cost investment, low maintenance and high production.

IDEAL FOR LAYING GAS, WATER AND CABLE LINES AND FOR DIGGING HOME FOUNDATION FOOTINGS

PICK THE POW-R-DITCHER TO FIT YOUR NEEDS

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Please send me FREE information and prices on the complete Vermeer line of self-propelled POW-R-DITCHERS.

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VERMEER MANUFACTURING COMPANY

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Part 1 . . .

LNG For Peak Shaving: A

W. J. Schreiner and R. H. Ormston,
Cincinnati Gas & Electric Company, Cincinnati, Ohio

Why Peak Shaving Is Needed

A very loose but adequate definition of peak shaving is *"the practice of supplying gas requirements from an alternate source during periods of high use."*

It is inherent to the gas industry that hourly, daily, and seasonal variations in the demand for gas require that gas utilities provide facilities suitable for varying rates of gas sendout. In general, these facilities are engineered to provide for:

1. An alternate supply of gas during emergency conditions
2. Failure of a single supply line
3. To overcome shortages in capacity of a single supply line
4. To reduce the cost of purchased gas through peak shaving processes
5. To improve purchased gas load factor

The economic desirability of peak shaving is always determined by the net results obtained when substituting the total annual cost (fixed charges and operating expenses) of peak shaving gas for the total annual cost (demand plus commodity charges) of the base pipe line gas. If a reduction in purchased gas costs exists it *must always* be reduced by the cost of the peak shaving gas.

The solution to peak shaving problems and problems relating to the economics of peak shaving is not a difficult undertaking. Many published papers have established acceptable formats that are readily applicable to most gas utilities' requirements. No single economic optimum solution exists. That which may apply or be economical for one utility is not necessarily economical for another. Peak shaving, therefore, can be thought of as an individual thing — and its economics are known only to the effecting utility, which after all is the guardian of its own best interest.

We can, however, make a series of general statements that are known to be common to all solutions:

1. It is usually economical to effect peak shaving if gas is purchased on a two-part rate i.e.: demand — commodity.
2. A two-part rate tilted to produce a higher demand component will yield higher net savings.
3. Low load factors tend to promote peak shaving.
4. High load factors tend to discourage peak shaving.
5. Unit cost of peak shaving gas (therefore savings) are hyperbolic functions and decrease (savings increase) with increased quantities of peak shaving gas. The greatest reduction per incremental increase occurs between 30 and 35% peak shaving. Additional peak shaving incrementals do not produce an appreciable reduction in costs.
6. An equation can be formulated representing the unit cost of pipeline gas and the unit cost of peak shaving gas versus day's use. The curve representing the unit cost of pipeline gas will intersect the individual curve representing the unit costs of peak shaving gas; therefore, the point of equal costs can be found.
7. The economics of all peak shaving processes is independent of the magnitude of the connected load but is dependent only on the configuration of the load-duration curve.
8. The effectiveness of existing peak shaving facilities decreases with increasing growth of connected space heating load unless additional peak shaving facilities are added.

EDITOR'S NOTE: Technological breakthroughs in the field of liquefied natural gas, particularly in non-conventional storage methods, are making the use of LNG for peak shaving more attractive for the future. Authors Schreiner and Ormston have developed a comprehensive economic analysis of the "why" and "how" of using liquefaction, storage, and regasification plants for peak shaving by gas distribution companies . . . pointing out both its advantages and disadvantages. This article was developed from a presentation made at a special technical symposium on "Liquefied Natural Gas Storage and Low-Temperature Processing" held at the Institute of Gas Technology, July 12-14, 1961. (Condensed versions of all symposium presentations are now being prepared and will be published in 1962 by IGT.)

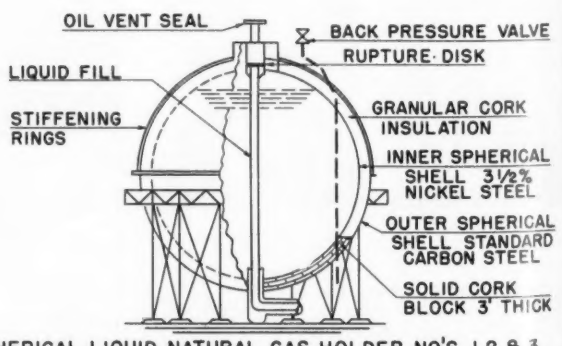


FIG. 1. Liquid storage tanks No. 1, 2, and 3 used in the Cleveland liquefaction plant.

g: An Economics Study

There are many other equally important factors which determine the economics of the peak shaving problem. They are of a special nature and are known only to the particular participating utility.

Fundamentals Affecting Economic Decisions

The economic decisions encountered in peak shaving problems are based on certain fundamental studies and compilation of data derived from operating experiences. These studies can be grouped into four general categories.

1. Statistical Studies
   a) General
   b) Physical
2. Engineering Studies
3. Financial Studies
4. Logistical Studies

Statistical Studies. This group furnishes the bases from which gas sendout is related to weather and area growth. Included in this group would be such statistical studies relating to:

1. Area weather data and probability of weather distribution in terms of severe conditions, average conditions and probable conditions.
2. Gas — sendout and its relation to temperature — a line of regression correlating sendout with mean temperature.
3. Load — duration — probable distribution of weather in terms of days duration.
4. Load — growth trends based on past experience and projected for future requirements.

The results obtained from statistical studies can be further classified into:

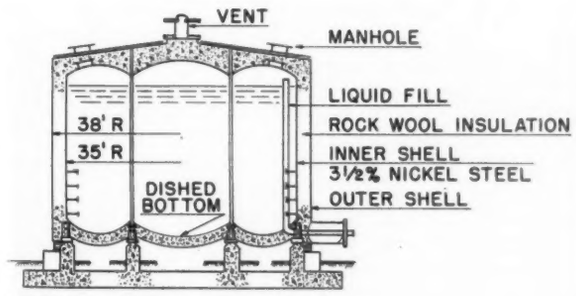
1. *General* — those results which are based on experiences (usually weather experiences) and do not exhibit appreciable changes from year to year. Among these are:
   a) Average annual degree days, 50 year base
   b) Average Degree Day — Duration, 20 year base
   c) Severe Degree Day — Duration, average of 5 severest years in 20-year period
   d) Probable Degree Day — Duration, preceding 5 year base
   e) Load — Growth trends based on past experiences and projected into future requirements
2. *Physical* — those results which are based on system requirements and which exhibited appreciable changes from year to year. Among these are:
   a) Base gas consumption
   b) Incremental heating consumption per degree day
   c) Annual pipe line gas demand cost
   d) Annual pipe line commodity cost
   e) Special contracts for sale of interruptable gas

The correct interpretation and application of the general and physical results are fundamental to the economic decision aspect of the peak shaving problem, for it is this phase of the study that determines the requirements to be satisfied by any peak shaving consideration.

Engineering Studies. This group of studies furnishes the bases from which maximum cost savings are derived. These studies can be grouped into two general categories:

1. Studies of processes available for use as natural gas substitutes together with investment and operating costs
2. Detailed costimating the process

The use of generalized published data can only be justified as a preliminary means to assign process cost, and as a means to eliminate those peak shaving processes that do not produce a cost savings. The accepted procedure is to



TORO - SEGMENTAL LIQUID NATURAL GAS HOLDER NO. 4
100,000,000 CU. FT. GAS

FIG. 2. Liquid storage tank No. 4 used in the Cleveland liquefaction plant.

PROCESSES FOR THE PRODUCTION OF PEAK LOAD GAS

1. **Natural Gas Storage**
   a. Low Pressure Holders
   b. Medium Pressure Holders (Hortonspheres)
   c. High Pressure Bottles
   d. Depleted Wells
   e. Liquefaction, Storage, and Regasification
2. **LPG-Air Gases (Propane)**
   a. Aboveground Tank Storage
   b. Underground Storage (Salt Domes)
   c. Underground Storage (Mined Cavern)
3. **High Btu Oil Gases**
   a. Light Oil
   b. Heavy Oil (Bunker C)
4. **Catalytic Reforming (Propane — Gasoline)**
5. **Coal Gasification (Lurgi Process)**

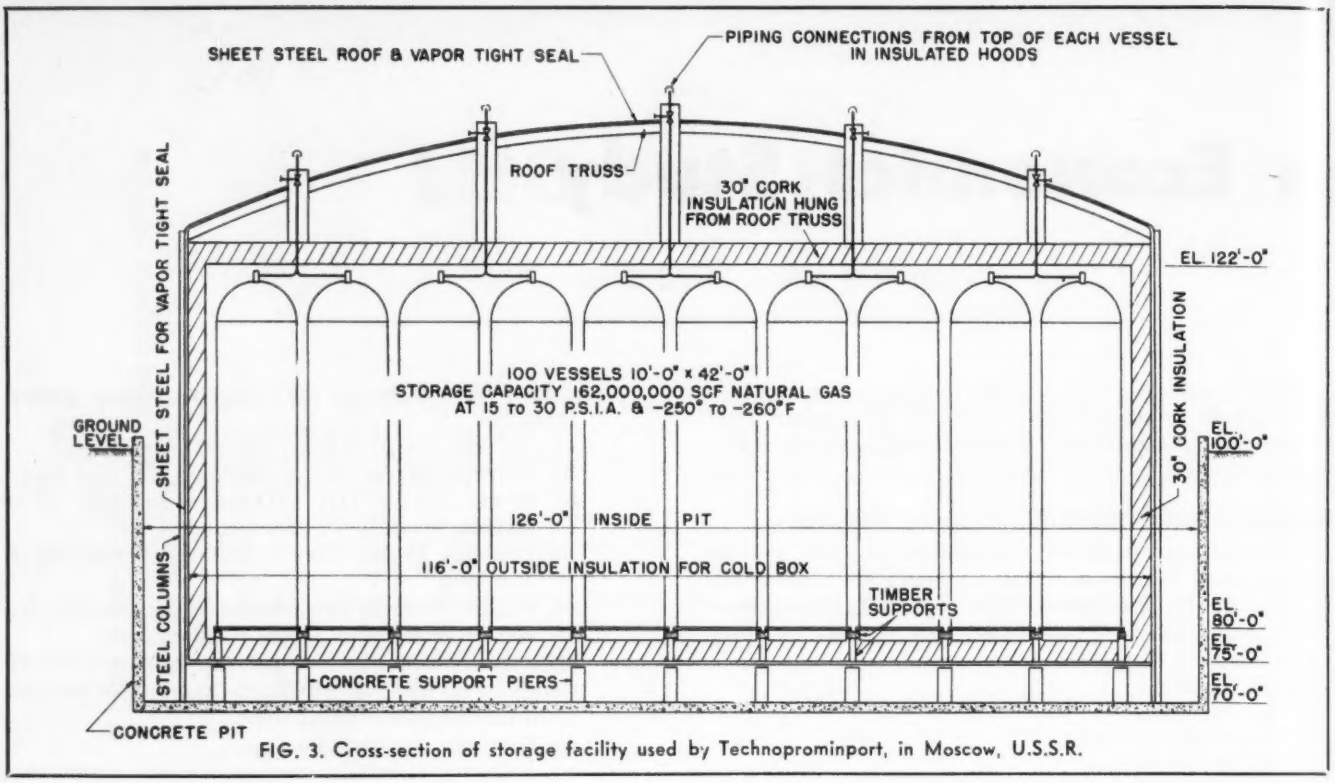

SHEET STEEL ROOF & VAPOR TIGHT SEAL
PIPING CONNECTIONS FROM TOP OF EACH VESSEL IN INSULATED HOODS
ROOF TRUSS
30" CORK INSULATION HUNG FROM ROOF TRUSS
SHEET STEEL FOR VAPOR TIGHT SEAL
EL. 122'-0"
100 VESSELS 10'-0" x 42'-0"
STORAGE CAPACITY 162,000,000 SCF NATURAL GAS
AT 15 TO 30 P.S.I.A. & -250° TO -260°F
GROUND LEVEL
30" CORK INSULATION
EL. 100'-0"
126'-0" INSIDE PIT
116'-0" OUTSIDE INSULATION FOR COLD BOX
STEEL COLUMNS
TIMBER SUPPORTS
EL. 80'-0"
EL. 75'-0"
CONCRETE SUPPORT PIERS
EL. 70'-0"
CONCRETE PIT

FIG. 3. Cross-section of storage facility used by Technoprominport, in Moscow, U.S.S.R.

choose the two most promising processes for further detailed costimating. These are always compared to the cost of additional increments of purchase pipeline gas and the purchase gas cost saving computed. The final selection of the peak shaving process is based on the process producing the highest cost savings.

Financial Studies. This group of studies determines the magnitude of the fixed charges or return on the money invested and is usually expressed in terms of a percentage of investment cost. Fixed charges are composed of and categorized into four general classifications:

1. Interest on investment or borrowings or dividends paid to stockholders
2. Depreciation, maintenance, and equipment insurance
3. Retirement or obsolescence, and inflation
4. Taxes and profits

The early concept of depreciation was to refer to funds laid aside for replacement of equipment. This simple concept is now complicated by new interpretations of taxation and inflation. At the present time, depreciation charges may mean "a percentage of the total investment that can by Federal tax regulations be withheld each year for income." Corporate taxes in the U. S. have amounted to as much as 52% of gross profits before taxes. In order to show a real profit of 3 to 6% on the investment, a gross profit of 6 to 12% must be realized before Federal Income taxes. Acceptable financial charges based on investment percentages for Items 1 thru 4 are:

1. Interest or dividends 6%
2. Depreciation 3%
3. Insurance 1%
4. Taxes 3%

The total financial charge is at least 13%.

Typical Investment and Operating Costs of Various Types of Peak Load Plants

Type of plant		Investment	Raw material[3]	Operating expenses[4]
Natural gas storage	High pressure bottled	$ 50–150[1]	0.30	0.10
Natural gas storage	Depleted wells	$ 1–2[1]	0.30	0.10
Natural gas storage	Liquefaction storage, and regasification	$ 15–20[1]	0.30	0.12–0.15
Propane air	Aboveground Tanks	$ 40–50[1]	1.65	0.10–0.15
Propane air	Mined cavern	$ 10–15[1]	1.65	0.10–0.15
High Btu oil gas	Light oil	$100–150[2]	1.50	0.15–0.20
High Btu oil gas	Heavy oil	$150–200[2]	.90	0.20–0.25
Catalytic reforming	Gasoline-propane	$100–135[2]	1.65	0.10–0.15

[1]$ per Mcf stored for storage-type plants.
[2]$ per Mcf produced da'ly for manufacturing plants.
[3]Gas or No. 2 fuel oil @ $0.11; propane @ $0.10; heavy oil @ $0.065, including tar credit, and natural gas @ $0.30.
[4]$ per Mcf supplied.

Application of LNG Plants to Peak Shaving

Meaning of Liquefaction. Liquefaction is the process of making or becoming a liquid. Liquefaction of natural gas occurs when its temperature is reduced sufficiently to cause condensation, the pressure necessarily being less than the critical pressure. Because natural gas is mostly methane (Table 2), this condensation would occur at −258 F under atmospheric conditions of 14.7 psig. In the liquid phase, 1 cu ft of liquid natural gas is equivalent to approximately 600 cu ft of natural gas in the gaseous phase, measured under standard conditions. Even at its critical pressure, the temperature of natural gas is extremely low and at 673 psia, it would be necessary to contain a liquid at −115.80 F.

It can be readily seen that under all conditions we are dealing with an extremely low temperature liquid, and a provision has to be made for insulation against ambient temperatures in order to contain the liquid in large volumes.

Storage of liquid gas at atmospheric conditions is desirable, since it would not be economically possible as well as mechanically possible to provide for storage of the liquid at higher pressures, in order to take advantage of the higher boiling point temperatures.

Storage of low temperature liquid gases in insulated containers has progressed at an accelerated rate during the last decade particularly in the liquid-air and oxygen production industries. The development of the missile and the

rocket are largely responsible for this. As these requirements become greater, plant capacities and storage facilities expand accordingly.

Methods used in the liquefaction of air are also applicable to the liquefaction of natural gas. Because natural gas is mostly methane, its behavior when compressed or expanded is further removed from the behavior of a perfect gas such as air, the result being that natural gas is easier to liquefy in the sense that its liquefaction requires less work.

When isoenthalpic expansion from one pressure level to a lower pressure level (i.e. Joule-Thompson effect) is used, relying on the deviation from the perfect gas laws to produce a drop in temperature, this advantage is particularly evident. The advantage is less marked when isoenthropic expansion (i.e. expansion engine) is used, because its effects are greater as the gas more nearly approaches a perfect gas.

Liquefaction of natural gas is a variable problem depending upon the inlet conditions of the gas supplied to the plant. The particular cycle chosen for the liquefaction rests on the process most applicable to those conditions.

In order to reduce the temperature of a system below that of its surroundings, heat must be extracted from the system by the performance of work in an organized manner. In general, the required work necessary for the liquefaction of a gas may be applied to produce a cooling effect in three ways:

1. The expansion of the compressed gas through a valve or throttling device without the performance of external work on the system, i.e. Joule-Thompson effect.
2. The expansion of the compressed gas in a special engine extracting from the system mechanical work.
3. Operate on the system by performing external work, i.e. direct refrigeration.

Referring to Table 1, we note that, historically, the popular choice of a liquefaction system is the type referred to as a cascade refrigeration cycle. Installations using the cascade cycle necessitate the use of high pressure gas compressors together with tonnage refrigeration equipment.

The Gas Utility Viewpoint. Gas is received into the utility purchaser's system at the city gate-terminal of the supplier's gas transmission facilities. Here the gas is measured for volume and sent into the utility's gas distribution system.

In order to deliver his commitments to the purchaser, the supplier must maintain a pressure (at his terminal of the gas transmission line) above a specific utilization pressure. The result is a pressure differential across the purchaser's point of supply under all conditions (even built into his system).

Discounting the purchaser's ability to "stock" or store gas, the rate at which gas is purchased by the utility purchaser will equal the rate at which the gas is consumed by the purchaser's customers. Therefore:

Rate of Supply = Rate of Consumption

The minimum utilization pressure of the purchaser cannot be singularly defined; there are many such pressures:

1. The minimum utilization pressure at the initial terminal of the purchaser's high pressure gas supply system.
2. The minimum utilization pressure of the purchaser's gas distribution system.
3. The minimum utilization pressure necessary to supply a customer's appliance.

In effect, we have established several pressure drops across the point of supply; these pressure drops are in order of magnitudes:

1. The customer's appliance (low pressure distribution system).
2. The purchaser's gas distribution system (low pressure distribution and intermediate pressure system).
3. The purchaser's high pressure gas supply system.

TABLE 1. Summary of Historical Development of Natural Gas Liquefaction, Regasification, and Storage Plants

Year Constructed and Plant Location	CAPACITY Liquefaction Mscfd	CAPACITY Regasification Mscfd	STORAGE Total Mscf	STORAGE No. Tanks	STORAGE Description of Tanks
1940—Hope Natural Gas Co.,* West Virginia (Pilot Plant)	300		1,000	1	Cylindrical 10′ dia. x 18′ long.
1941—East Ohio Gas Co.,* Cleveland, Ohio (operated 3 yrs; destroyed by fire October 20, 1944)	4000	72,000	267,500	4	3 Spherical (See fig. 1) 1 Toro Segmental (See fig. 2)
1947—Moscow U.S.S.R.* (Lend Lease-believed to be in operation)	4500	48,000	162,000	100	Cylindrical (See fig. 3)
1954—"Constock"— Continental Oil Co. and Union Stock Yard,* Lake Charles, La.	7000	none	100,000	1	Cylindrical (See fig. 4)
1959—British Gas Council James River, England (Receive liquid by Ship Methane Pioneer)	—	—	60,000	1	Cylindrical (See fig. 4)

*Liquefaction Cycle—Cascade

Refrigeration Cycles

This inherent pressure drop across the point of supply could in theory be utilized as a source of refrigeration. If, for instance, the drop across one midwest utility's supply pressure and appliance minimum utilization pressure is considered to be adiabatic isoentropic expansion, the refrigeration potential based on the utility's average day sendout as a basis would be at least 2000 tons. Based on a peak day's sendout, this refrigeration potential could be approximately 6500 tons.

TABLE 2A. Typical Analysis and Physical Properties of Constituents Natural Gas Supply to A Midwest Gas Distribution Utility

Component	Formula	Molecular weight	Boiling point, °F	Freezing point, °F	* Mole %
Nitrogen	N_2	28.00	—320.4	—	0.36
Methane	CH_4	16.04	—258.6	—296.5	94.3
Ethane	C_2H_6	30.07	—128.2	—297.8	3.1
Carbon dioxide	CO_2	44.00	— 69.9**	— 69.9**	0.74
Propane	C_3H_8	44.09	— 43.7	—305.8	0.86
Iso-Butane	C_4H_{10}	58.12	10.9	—255.0	0.19
N-Butane	C_4H_{10}	58.12	31.1	—216.9	0.21
N-Pentane	C_5H_{12}	72.14	96.9	—201.5	0.09
N-Hexane	C_6H_{14}	86.17	155.74	—139.5	0.07
N-Heptane	C_7H_{16}	100.19	209.17	—131.0	0.04

Gross Heating Value ..... Btu per Scf = 1038
Specific Gravity (Air = 1) ..... = .597
*Typical Mass Spectrometer Analysis Natural Gas
Cold Springs 24" T/L IGT Run #K-322 10-8-59
** Triple Point CO_2 @ 5.1 Atmos (75 psia)

TABLE 2B. Properties of Methane, CH_4

Mol weight	16.042
Boil pt	—258.68 F
Freezing pt	—296.46 F
Critical pt	—115.8 F @ 673 psi
Flash	—306 F
Latent heat vaporization @ boiling pt	219.2 Btu per lb
Density of liquid	0.415 gr per cu cm @ —164 C
Density of liquid	25.85 lb per cu ft
Density of gas	0.7168 gr per liter @ 760mm, 0°C
Density of gas	04475 lb per cu ft @ 32 F and 14.7 psia
Specific gr gas	.5544 (Air = 1) / .5016 (0_2 = 1)
Total heating value	23861 Btu per lb / 978 Btu per cu ft
1 cu ft sat liquid @ 14.7 psia	578 cu ft gas @ 32 F and 14.7 psia

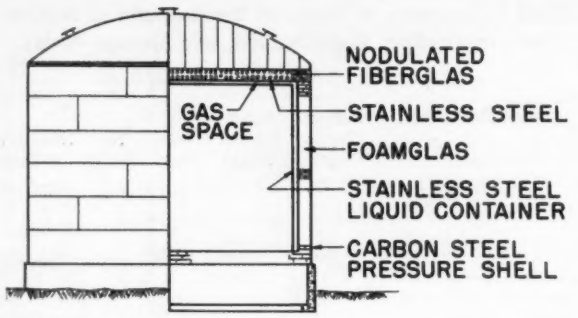


FIG. 4. Construction of a modern cryogenic storage tank.

This refrigeration potential can be realized by the application of special cryogenic cycles and equipment, thus materially reducing the inherent high investment cost of the conventional, i.e. cascade refrigerating cycles, commonly associated with LS&R (liquefaction, storage, and regasification).

Unconventional alternate cycles embracing this doctrine that merit detailed investigation are:

1. **High Pressure Expander Cycle.** Similar to the *Claude Air Liquefaction Cycle,* where primary refrigeration is gained through compression of process gas to high pressure and subsequent expansion of part of the process stream by means of an expander. Liquefaction is completed through a series of Linde expansions to storage pressure. This cycle operates at 1500 psia.

2. **Low Pressure Expander Cycle.** Similar to the *Kapitza Air Liquefaction Cycle* wherein pipeline gas is expanded from the pressure received by means of an expander, thus, furnishing the refrigeration necessary to liquefy a portion of the pipeline stream. This stream is subsequently expanded directly into a liquefier and a portion is withdrawn as a liquid to storage.

3. **Nitrogen Cycle.** Direct cooling with a nitrogen refrigeration circuit incorporating expander driven nitrogen compressors. Preliminary precooling of pipe line gas through an expander-compressor circuit. Liquefaction of the pipe line gas is carried out in a liquefier wherein the liquid gas is subcooled before expansion to storage pressure. Subcooling eliminates the necessity for recycling the pipeline gas.

4. **High Pressure Linde.** Similar to the *High Pressure Linde Air Liquefaction Cycle* where high pressure gas is expanded to intermediate pressures by means of expansion valves. The portion of the pipe line gas which is not liquefied is recycled.

TABLE 3. Compressor Requirements per 1,000,000 SCFD, Cascade Cycle.

Compressor	Brake horsepower	Percent total horsepower requirements
Feed gas compression	150*	18.4
Flash gas re-compression	240	29.4
Ethylene refrigeration compression	300	36.6
Ammonia refrigeration compression	125	15.6
Total requirements	815	100.0

* from 45 psia suction to 620 psia discharge

TABLE 4. Summary of Cost Estimates for Various LNG Containers*

	Estimated cost per Mcf storage**
1. Above ground doublewall tanks	$2.85 — $3.42
2. Mined and lined cavern	$1.55 — $2.12
3. Quarried limestone pit, lined and covered	$0.71 — $0.77
4. Buried prestressed concrete tank, lined	$1.25 — $1.50

* According to Eakin in article "Non-conventional Storage of Natural Gas," American Gas Journal November, 1960, Pages 20-24.
** Basis = 1 Billion SCF Total Storage.

A detailed and comprehensive engineering study of each of these process cycles should be undertaken as part of any economic study relating to LS&R. The effect of the process cycle chosen on the cost of hardware cannot be overemphasized. Operating costs are also affected by the selection of the process cycle. Operating power costs can range from almost trivial as indicated by process cycle 2 (if the utility is fortunate enough to receive its pipeline gas at high pressure in large quantities and be able to expand directly into a distribution system) to significantly high operating costs indicated by process cycles 1, 3, and 4.

A general analysis of advantages and/or disadvantages of the process cycles 1, 2, 3, and 4 when compared to the conventional cascade cycles are:

1. **High Pressure Expander Cycle**
   a. The horsepower requirement of the high pressure expander cycle is somewhat higher than the conventional cascade cycle.
   b. Less hardware is required.
   c. Low temperature heat exchangers are of the expensive multi-circuit Hampson or Collins construction.
   d. Partial liquefaction occurs, the major fraction (nonliquefied portion) of which requires recycling through the cycle necessitating consideration of provisions for nitrogen removal.
   e. Horsepower is recovered from the expander shaft work and is transformed into auxiliary refrigeration for increasing cycle efficiencies through precooling the process stream prior to expansion.
   f. This cycle shows promise where larger liquefaction rates are desired (10 MMcfd or greater).
   g. First hardware investment costs are considerably lower than the conventional cascade cycle. The annual operating cost will be somewhat higher due to the higher horsepower requirements.
2. **The Low Pressure Expander Cycle**
   a. Requires large flows of pipe line gas, therefore, the size of the hardware becomes correspondingly greater.
   b. The larger the available pressure drop across the point of supply, the greater the efficiency of the cycle.
   c. Cycle does not require performance of work, i.e. horsepower input.
   d. Horsepower is recovered from the expander shaft and used for compression of the process gas to higher pressure levels.
   e. This is a once-through cycle with 3 to 4% of the throughput remaining and available for storage as a liquid.
   f. Cycle efficiencies can be greatly improved to any desired magnitude through introduction of an auxiliary refrigeration cycle with precooling of the process stream.
   g. Gas conditioning is critical to this cycle since large quantities of conditioned gas are required.
   h. Multi-circuit reversing exchangers of the Hampson or Collins type are required; this exchanger also conditions the gas by freeze-out of the carbon dioxide and water vapor.
   i. The expander is also critical since it must be able to run "wet" as well as handle large quantities of gas flow.
   j. This cycle shows very good promise in that it minimizes the first hardware investment cost as well as the annual operating costs.

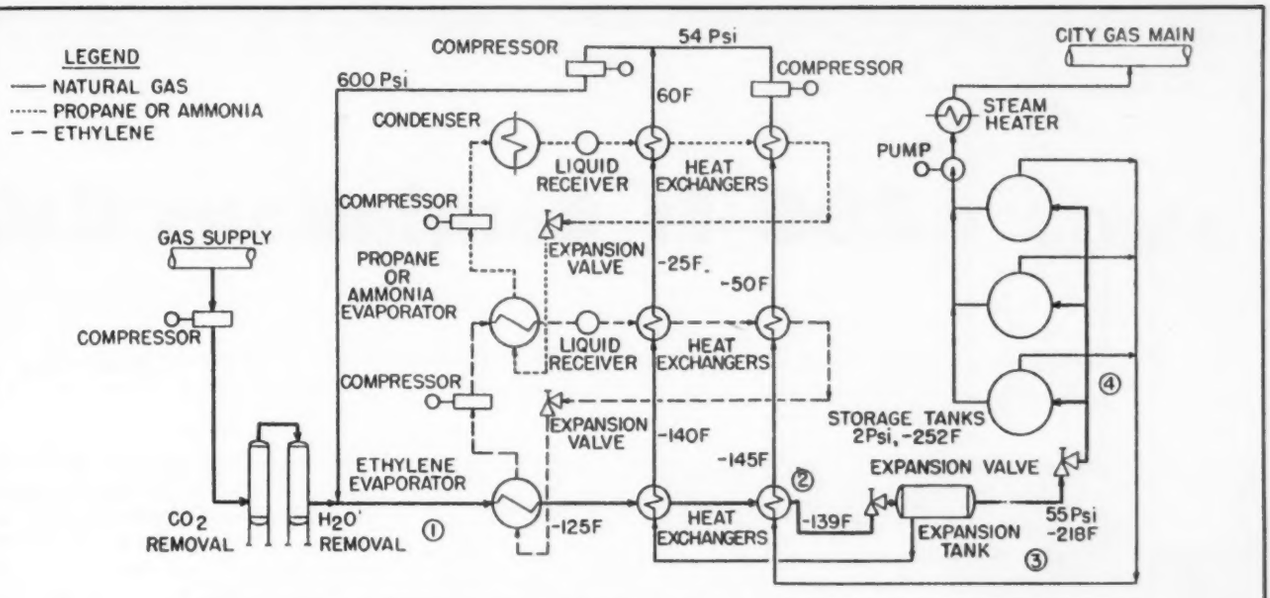


Diagram shows flow through liquefaction plant. Gas temperature is reduced in four steps. Vapors from final two steps — expansion tank and expansion into storage tanks — are recycled.

k. Successful application of this cycle depends on certain inherent advantages which must be present in the participating gas utility's gas distribution system.

3. **High Pressure Linde Cycle**
   a. Horsepower requirements of the Linde High Pressure Liquefaction Cycle are considerably higher than the conventional cascade liquefaction cycle.
   b. Heat exchangers are of the expensive multi-circuit Hampson of Collins type; however, the number of exchangers used is considerably less than used in the cascade cycle.
   c. For small LS&R plants an investment cost savings is realized but annual operating costs are significantly higher.
4. **The Nitrogen Cycle**
   a. Great promise where both large and small liquefaction rates are desired.
   b. Coupled with precooling through horsepower recovery of expanded pipeline gas, this cycle effects an investment cost savings as well as an operating cost savings.
   c. Most of the favorable aspects of the conventional cascade cycle are retained, utilizing less hardware.
   d. The no-recycle and horsepower recovery aspects produce a cycle that requires less compressor horsepower; therefore, less annual operating expense than the conventional cascade cycle.
   e. The cycle is simple, direct, and easily controlled.

The future role of the expander is obvious. Its dual advantages, refrigeration and horsepower recovery, will definitely be incorporated in the design of the forthcoming LS&R plants. A significant cost of hardware reduction results in many, if not most, cryogenic applications of expanders. This cost of hardware reduction is always accompanied by a reduction in horsepower requirements, since the net work input is represented by the difference between the power required for compression and that available from the expander.

The Cost of Liquefied Gas Storage

Storage of liquefied natural gas represents the major cost element of LS&R peak shaving installations. LNG storage is also the major design problem confronting the utility engineer.

In its very general sense, the storage problem resolves itself into containing, as economically as possible, large quantities of extremely cold liquid at a relatively low temperature.

Two solutions to the storage problem are applicable:

1. **The conventional solution.** Above-grade, insulated double shell storage containers of cylindrical or spherical configuration.
2. **The non-conventional solution.** Below-grade storage in prestressed concrete tanks—lined or unlined, mined caverns, or surface quarried pits.

The Cleveland storage plant and the Moscow storage plant are examples of the conventional solution of large volume liquefied pipe line gas storage. Details of the design and other descriptive material pertaining to these installations are given. Fig. 1, 2, and 3 refer to these installations. Fig. 4 shows the arrangement of a modern cryogenic storage tank.

Table 4 presents the cost of various storage methods based on a total storage of 1-billion scf of liquefied natural gas. The cost of storage increments less than 1 billion scf would be considerably higher. It is important to note that Table 4 does not include the cost of additional liquefaction hardware introduced by the increased liquefaction capacity required to maintain a desired liquid storage inventory.

Non-conventional storage containers have an inherent high volume loss due to boil-off caused by heat infiltration. This is not indicative of undesirability, since storage efficiencies of non-conventional storage containers generally improve with respect to lapsed time. A fraction of LS&R plant liquefaction capacity rate is designated for filling the container; the remainder is designated to replace the liquid loss by boil-off.

The most promising and the most significant break through in the application of LS&R to peak shaving will be forthcoming as the result of the first successful application of non-conventional storage plants.

Next Month: In Part 2, the authors describe how to determine requirements and costs for liquefaction, storage and regasification (LS&R) plants; a sample economic analysis of a typical plant, and current unit cost data.

300-Ft Continuous Bore

Dean Hale, *Editor*

Water line (hose at left) is attached to bore pipe at far end. At center can be seen additional lengths of bore pipe to be added as bore progresses. At right is 2-in. coated and wrapped pipe, made up for installation.

CONTINUOUS BORING—up to 500 ft at a whack — is helping Southern Counties Gas Company install street mains with a minimum of pavement breaking and patching.

Key to the new operation is the "Hydra-Mole," an ingenious boring machine that readily adapts to any hydraulic backhoe and which was designed basically for installing pipe with speed and economy.

Southern Counties Gas is using the new technique to install both new mains and replacement mains. In a typical job illustrated in this article, approximately 1000 ft of 2-in. main was replaced by boring-in the new main. Each bore was approximately 300 ft in length. Bell holes were dug at each point where service line connections were made, and "slots" for the Hydra-Mole were dug at the beginning of each bore.

The procedure is relatively simple. A pilot bore the size of the drill (or bore) pipe is made first. On this job, ¾-in. pipe was used.

After the pilot bore is made, the pipe is withdrawn, larger bits are used for reaming and the bored hole is reamed from one to four times, depending on the size of main to be installed.

Once the bore hole is reamed to size, the pipe is then installed manually by pulling it into place with a winch line.

Southern Counties installs yard coated - and - wrapped pipe without damaging the coating. The bore is made "wet"—water is forced through the bore pipe during boring operations to facilitate boring and to wash out cuttings—and the wet bore, muddy so to speak, serves to lubricate the pipe movement through the bore hole.

Advantages of the new technique, as enumerated by Southern Counties Gas' Santa Monica division superintendent Ron Merrick and construction foreman Larry Baumler, are many.

Savings in equipment is a large item. The hydraulic backhoe used for boring with the Hydra-Mole is also used to

Help Cut Main Installation Costs

Southern Counties Gas Company utilizes new "Hydra-Mole" boring machine for main laying to eliminate paving repairs and better utilize equipment

dig the bellholes and slots needed for the main installation.

Boring with the Hydra-Mole is speedy and pipe can be installed sooner than with conventional full trenching methods. Savings are also made in paving replacement costs, and public relations are improved by not having streets, cross streets, driveways, and walkways subjected to open trench for several days.

Boring Machine Details

The Hydra-Mole, essentially, is a hydraulic motor powered pipe rotating device with a specially designed chuck for engaging and holding the bore pipe. The chuck is designed to engage the pipe while rotating in one direction and releasing it when rotated in the opposite direction.

Boring can be accomplished at rates up to one foot per second horizontally, depending on pipe size, soil conditions, and gear ratio of the model used. Rotation speed can be varied by the operator from 50 to 400 rpm.

The Hydra-Mole is powerful—it can endload the bored or rotated object up to seven tons. Torque produced is sufficient to flatten a 1-in. pipe. Both torque and end load can be varied by the operator to meet varying conditions.

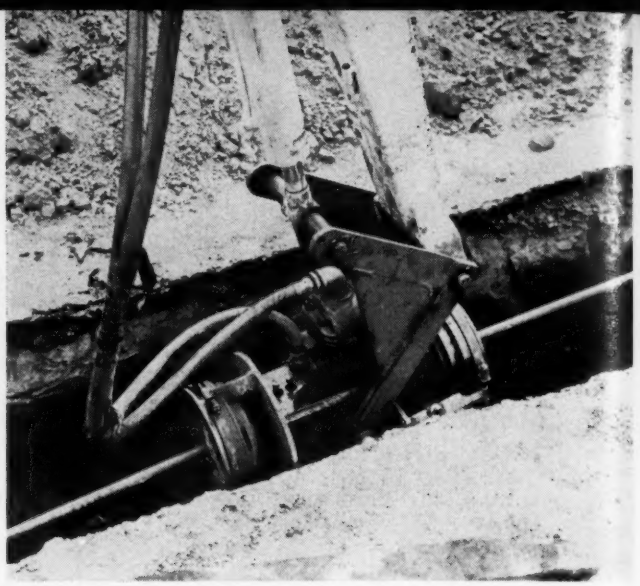
For boring, any type of pipe, drill rod, hex rod, or similar material from ⅜ to 3-in. diameter can be handled directly in the Hydra-Mole. With a reaming and packing procedure used in conjunction with boring, pipe up to 12-in. diameter can be handled.

Bore length limit hasn't been established. Jobs up to 500 ft in one continuous bore have been made. For convenience, Southern Counties generally keeps bores to approximately 300 ft or less.

Soil conditions present few problems when using the Hydra-Mole. The device can bore either wet or dry. Southern Counties pumps water through the bore pipe and out small jets drilled in the bits at the bore end. The hydraulic washing action of the

Backhoe operator Al Berger and assistant check attachment of Hydra-Mole boring machine to backhoe boom.

Boring machine in operation. The Hydra-Mole engages and rotates the bore pipe. Movement of boom controls forward movement of the pipe.



Close up of the Hydra-Mole. Only two hydraulic line connections are required.

Winch truck is positioned just forward of bore slot. Pipe for new main, assembled and on rollers, will be pulled by winch line.

As boring progresses, crew members make up the pipe to be installed. Pipe is moved on padded two-wheel carriers.

water under pressure aids in boring, washes cuttings from the hole, and provides a "slippery" interior that aids in installing the pipe.

Being hydraulically operated and of watertight construction, the Hydra-Mole can be operated while submerged in water or mud, without damaging the machine.

The boring machine can operate in any attitude — horizontal, vertical, or any angle between. It can be used for moving or rotating many other types of objects.

The boring device weighs approximately 450 lb, is 14-in. wide and 28-in. long. It is readily adaptable to any hydraulic backhoe, where it replaces the digging bucket, and attaches in a brief time. Power for rotating the Hydra-Mole is supplied by the device's own hydraulic system; the hydraulic system that powers the backhoe is used to provide power for thrusting the Hydra-Mole.

Boring Procedure

Here's how a typical gas main installation using the boring method is accomplished:

1. The job is laid out in advance with all the bell holes marked and route of main carefully positioned. Bellholes should be approximately 1½ ft by 3½ ft. For boring in one direction only, the "spud-in" or "gopher" method is used — a sloping trench down to point where main is to begin. For boring in two directions, a long "slot" is used.

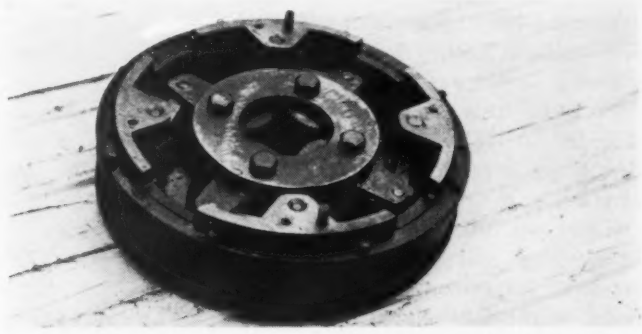
2. Pavement is broken sufficiently for backhoe to remove and the spoil is placed so as to not interfere with bore aligning. All substructures and foreign piping should be located during excavation to prevent damage by the backhoe. All bellholes are excavated

At target hole, crew member checks alignment of bore pipe as it passes through bellhole where service line connection is to be made to new main.

Bore pipe with reaming bit attached is shown entering pilot bore hole. Pilot bore was approximately ¾-in. Reamed hole will accommodate new 2-in. main.

Pipe roller, designed by Southern Counties distribution construction men, carries pipe during installation, prevents damage to coating.

Bits used include, left to right, 5-in. OD reaming bit (for installing 3-in. pipe), 1½-in. boring bit, and ¾-in. boring bit.



Special chuck design allows teeth to engage and firmly hold pipe when chuck rotates in one direction. Rotation in opposite direction releases pipe, allows boring machine to be moved forward or backward.

to sufficient depth to accommodate remaining earth around main and service. Final shaping of bellholes is done by hand.

3. Assembly of boring equipment includes use of ¾ or 1-in. extra heavy pipe with a 1 or 1½-in. bit. Sufficient lengths of pipe for the entire bore should be assembled behind the unit. The bit is then installed on the bore end and water connections made on opposite end.

4. Aligning guides are used to insure a straight bore and target for operator to follow is placed in furthest practical hole. Water connections and flow of water at bit are tested. Backhoe is positioned exactly over center of main location. Bore pipe is then separated at a suitable joint to permit the boring machine to be positioned, pipe run through the chucks, and pipe engaged.

5. The boring machine is engaged and bore pipe is reconnected. When water appears in the target hole, the water is turned off and alignment of the drill pipe is checked. As boring continues into next section, water is again turned on.

6. Reaming can be accomplished several ways. One is to put the reaming bit on the borestem and then pull the stem back with the boring machine, rotating the bore pipe and reaming bit. Or the bore pipe can be withdrawn, reaming bit attached, and boring procedure repeated.

7. The pipe to be installed is made up and placed on rollers. Three to four rollers are normally used in a 300-ft length of pipe. A smooth, round-end plug is used on the initial end and the winch cable is attached at the rear end. The pipe is then pulled the entire length by the winch cable. * * *

Gas Heating Customers Increase by 1,200,000 in 1960

More homes are being heated with gas in the United States than ever before. The American Gas Association reports that an additional 1,171,000 customers installed gas heating last year. There were 21,352,000 customers heating with gas at the close of 1960, an increase of 5.8 percent over the previous year, according to A.G.A.'s annual gas househeating survey.

The survey predicted that in the three-year period ending in 1963, more than 3,564,000 new gas heating customers will be added. New customers accounted for 62 percent of the installations of gas heating in 1960. The remaining 38 percent made conversions from other fuels in existing dwellings. The annual A.G.A. survey made the percentage breakdown nationally and by state for the first time.

There was no national pattern, A.G.A. noted, and in some areas conversions outnumbered new installations. In the East North Central Region, for example, which experienced the greatest growth both in absolute number and in percentage, 61 percent of the installations were in existing homes. This region, which includes Illinois, Indiana, Michigan, Ohio, and Wisconsin, added 387,000 gas house-heating customers in 1960, bringing the total to 4,594,000.

By contrast in the Pacific region, which includes Alaska, California, Hawaii, Oregon and Washington, and ranks second in the number of customers added, 93 percent of installations were in new homes. This area had a total of 196,000 installations, all but 14,000 of them in new homes. There are now 4,360,000 dwellings in the region with gas heat.

New Jersey, New York, and Pennsylvania, which make up the Middle Atlantic Region, experienced the third greatest gain. In those states, the distribution between new homes and existing homes making installations was much closer than in the other two regions. Newly-built homes accounted for 58 percent of gas heating installations and existing dwellings 42 percent. The installations added in the region were 152,000, bringing the total number of customers in the three states to 2,523,000.

Of the total number of residential customers of gas utilities, 69 percent used gas for heating in 1960, compared to 67 percent the previous year.

Because of the continuing demand for gas heating, A.G.A. estimates that in 1961, 1962, and 1963, a total of 2,377,000 homes will install gas heating and 1,187,000 existing houses will convert to gas. The figures refer to the number of customers, not the sale of heating units, because some dwellings may have more than one piece of gas heating equipment, especially in the case of the direct space heaters, floor furnaces or vented recessed wall heaters.

At the close of 1960, complete or partial restrictions on the installation of new gas heating equipment were placed on 37 utilities by state regulating agencies or by the utilities themselves. This is equivalent to 12 percent of total gas utility residential customers. A year earlier, gas companies serving nearly 15 percent of all residential customers had reported some restrictions.

The annual A.G.A. survey was based on reports submitted by nearly 400 companies who served 29.7 million residential gas customers in the U. S. at the close of 1960. These companies represent 96 percent of the industry's total customers.

Data submitted by individual companies indicated the number of residential users and heating customers, anticipated new installations and the existence or absence of heating restrictions. Industry totals were developed from these reports and from estimates for non-responding companies, and thus represent the entire gas utility industry. A.G.A.'s annual survey is used by gas heating equipment manufacturers in determining the magnitude and location of markets for their products. * * *

Residential Customers of Companies Reporting Gas Heating Restrictions 1951-1960

Year	Number Reporting Restrictions	Residential Customers (millions)	Companies' Percent of Industry
1951	N.A.	11.2	48
1952	120	10.2	42
1953	88	9.1	36
1954	N.A.	N.A.	N.A.
1955	61	6.7	25
1956	58	5.3	19
1957	55	5.4	19
1958	53	5.3	18
1959	56	4.4	15
1960	37	3.6	12

N.A. Date not available

Two workmen lower long section of plastic pipe into trench by hand. Jointed sections of pipe are tested at 50 psi for 24 hours before lowering in. Watching the operation is a workman for the excavating contractor.

Peoples Pipes 7 Towns With Plastic

Dick Grau, *Distribution Engineer*
Peoples Natural Gas Division,
Northern Natural Gas Company,
Omaha, Nebraska

Seven Northern Plains towns have been outfitted with brand new plastic gas distribution systems by Peoples Natural Gas, distribution division of the Northern Natural Gas Company of Omaha, Nebraska.

Northern is extending its pipelines to 165 towns in Iowa, Minnesota, Nebraska, Illinois, South Dakota, and Wisconsin this year and its Peoples Natural Gas division is building distribution systems in 44 of those towns.

Peoples' engineers, who have watched with interest the growing use of plastic pipe since the outbreak of World War II, selected the towns of Fertile, Fostoria, Hanlontown, Superior, and Wallingford in Iowa, Jackson in Nebraska, and Viola in Minnesota as locations for their own plastic gas distribution systems.

All seven of the towns selected for Peoples' plastic systems have from 50 to 100 potential natural gas consumers. None of them has big users of natural gas, so main and service line sizes vary little within the town.

Five of the plastic gas systems were in service by mid-August and the other two were scheduled to be completed before the advent of cold weather.

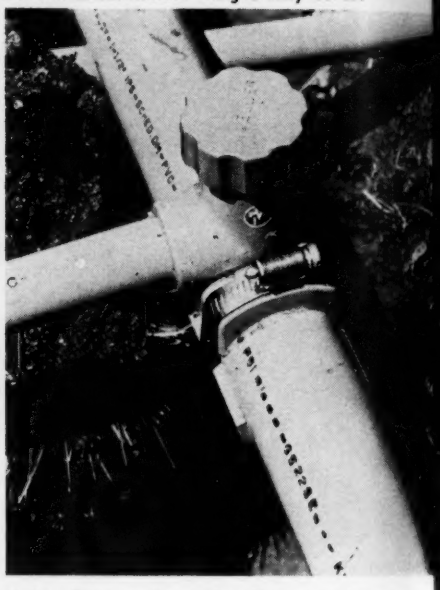
The plastic systems installed thus far have been built at estimated savings of 30% under the cost of steel pipe distribution systems that are in use in the 150 other Northern Plains towns that are served by Peoples Natural Gas.

If operating experience with the plastic systems is satisfactory, plastic is expected to play a bigger and bigger

Long sections of assembled plastic pipe can be moved with ease. This section was assembled and pressure tested on the lawn of a church and then carried across the highway for lowering into a trench.

Joined sections of 2-in. pipe illustrate its flexibility. Pipe sections are ready for lowering into the ground after trenching machine mounted on jeep (background) finishes its work.

Lightweight PVC plastic pipe can be moved about on the shoulders of workmen. Peoples' employees Lynn Wee and Ronald Rogers are carrying 500 ft of ¾-in. pipe for service lines. Bundle weighs only 60 lb.



Valve tees and service lines can be connected to plastic mains while pipe is at ground level. Photo shows how a half sole and steel bands are used to strengthen service take-off assembly. Valve tee and half sole are both joined to main with acetate solvent.

role in Peoples Natural Gas distribution plans.

Northern's Peoples division is not a pioneer in the plastic pipe field. By the end of 1961, it is estimated that 78 gas distribution companies will have installed 3350 miles of plastic pipe in the United States.

It was almost a dozen years from the time plastic pipe was first used in gas mains until the first 1000 miles were in the ground in 1954. Only six more years were needed for installation of the second 1000 miles and the third 1000 miles is taking only 18 months.

During its brief history, plastic gas pipe has been used about equally for new mains, new service lines, and inserts and replacements in mains and service lines.

All of the many types of plastic pipe available are completely inert, unaffected by electrolytic corrosion, scale and rust, and resistant to acids, alkalies, oils, bacteria, rote and fungi. They need no cathodic protection nor coating and wrapping.

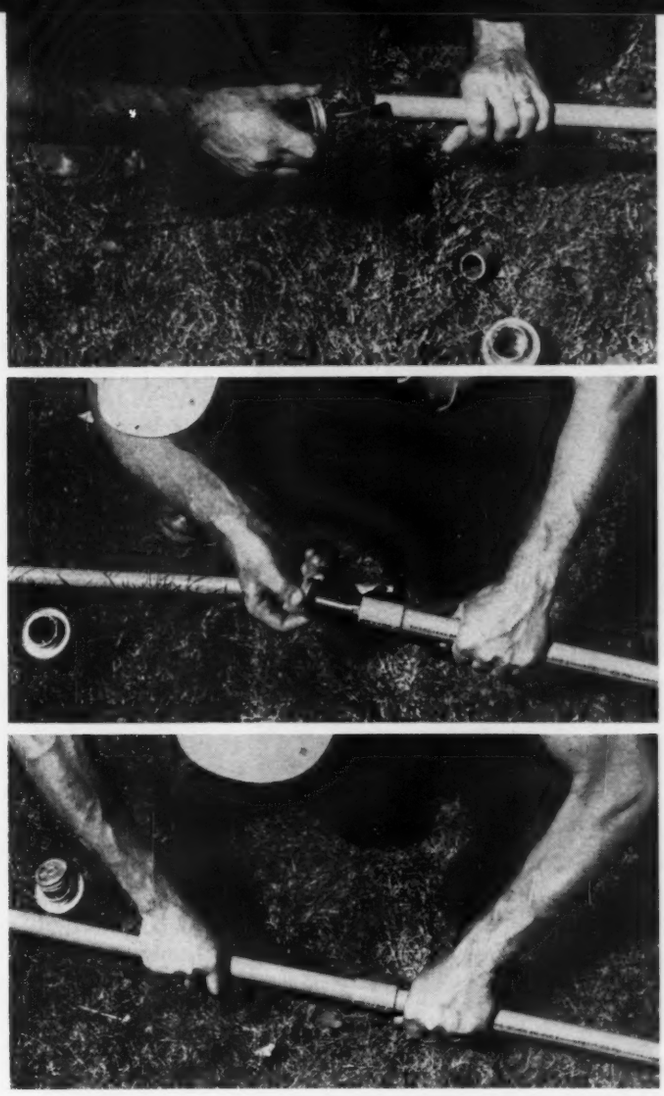
Peoples' engineers selected polyvinyl chloride (PVC) pipe for their plastic systems. In the seven Peoples PVC plastic pipe gas systems there are slightly more than nine miles of pipe. The installations required 9700 ft of 2-in. pipe, 52,800 ft of 1½-in. pipe, 2200 ft of 1¼-in. pipe, and 27,000 ft of ¾-in. pipe. The two larger sizes are used for mains and the two smaller sizes are used for commercial and residential service lines.

The transition from steel to plastic gas mains is made at the district regulator station in each of the seven towns where pipeline pressure is reduced from 50 psi to less than 10 psi. The steel and plastic pipe are joined with a Dresser coupling. Compression couplings utilizing a bushing are used at points where main sizes drop from 2 to 1½-in.

The PVC plastic pipe is used throughout the seven distribution systems from the district regulator station until the gas reaches the steel transition risers that connect to the gas meter at each home or business place connected to the system. The steel transition risers are made with a plastic band forced securely onto the end that connects with the plastic service line.

First task in building a gas distribution system — digging trenches for the lines — is no different for plastic pipe than it is for steel pipe. Slightly less excavation is required in the plastic system because there is less need for work space in the trenches.

Laverne Fanter and Bernie Marcks complete the assembly of a tee-joint on a 2-in. plastic main in the Peoples distribution system at Superior, Iowa. Same acetate solvent joining techniques are used in the 2-in. and 1½-in. mains.



Joining sections of PVC plastic gas pipe with acetate solvent is done quickly and easily. Workman coats end of a 20-ft section of pipe with the solvent (top photo), slips a plastic coupling over the pipe end, and covers the inside of the extended end of the coupling with more solvent (middle photo). Finally, he slides the second section of pipe into the coupling, gives the assembly a twist to make sure the acetate is spread evenly and then holds the joint firmly for 20 to 30 seconds while it forms a solid union (bottom photo).

Four to five men were able to install the plastic distribution systems in each of the five towns piped thus far in about two weeks. An estimated twice as many workmen would have needed almost four weeks to install a welded steel gas distribution system in each of the same towns.

What are some of the reasons for this saving of time and manpower? For one thing, the joining of PVC plastic pipe is an amazingly quick and simple process.

A workman applies a coating of acetate solvent to the last 1½-in. of the exterior of the section of plastic pipe and slips a plastic coupling (that has been coated internally with the solvent) over the acetate-covered end of the pipe, giving it a quarter turn to make sure that the acetate is spread evenly over the pipe end and the coupling. The second pipe section, with its end also coated with acetate, is inserted into the coupling, given a quarter turn and then the joined sections of pipe and the coupling are held firmly together in the workman's hands for about 10 seconds while the acetate forms a solid bond between the pipe ends and the coupling. This process is repeated for each section of pipe.

Transition risers at the meter ends of the service lines are joined to the plastic lines in exactly the same way.

The plastic connections are strong. Peoples' workmen have tried to pull and pound them apart with little success. The acetate solvent should be fresh and the pipe ends and couplings should be clean to insure a strong, permanent joint.

Plastic pipe used in Peoples' distribution systems can be quickly cut into desired lengths with a hand saw or hack saw. The only tool needed to install service valve tees, also made of plastic, is a brace and bit, using a screwdriver type of bit to screw the punch through the main. The valve tee, which clamps onto the plastic main in the same manner a saddle fits a horse, is attached firmly to the main with the same acetate solvent used to join the sections of pipe. For added strength at the service takeoff, a plastic half sole is placed on the main directly under the valve tee. Finally, two metal bands and clamps embracing the service tee, half sole and plastic main add a little more ruggedness to prevent damage during backfilling.

When the valve tee cap is unscrewed and removed, the brace and bit is used to screw the tap through the plastic main to form the service opening.

Steel transition risers are attached to the plastic service lines as easily as the sections of pipe are joined. Steel riser is manufactured with a band of plastic forced firmly onto the end that joins the service line. Coupling slips over the plastic band on the steel transition riser and over the end of the plastic service line, and assembly is joined solidly with acetate solvent.

Drawing the tap up to the top of the tee serves as a positive shutoff valve.

Hot taps can also be made onto the plastic main with the plastic valve tees.

The PVC plastic pipe is so light and flexible that the valve tees and service lines are attached to the mains at ground level and the whole assembly is then lowered into the trench by hand. The light weight is another labor-saving advantage in the installation of PVC plastic pipe.

A 20-ft section of PVC pipe weighs less than 10 lb. A 500-ft bundle of ¾-in. pipe weighs only 60 lb. Once the pipe has been unloaded at a warehouse in the town to be piped there's almost no need for trucks to transport it. Workmen frequently place a bundle of the pipe on their shoulders and carry it where it's needed.

It's not necessary, either, to string the pipe along the trench into which it will be placed. Workmen can join long sections of the PVC pipe in any convenient location and three or four men can carry 200 to 300 ft of joined pipe a considerable distance with little effort.

The pipe's light weight and its flexibility simplify lowering into trenches. PVC plastic pipe easily follows the contour of hilly terrain and it will readily adapt itself to a curved trench. That's a big advantage in new subdivisions featuring winding, twisting streets.

Plastic pipe is tough, but it is susceptible to damage from excavating equipment. The same features that make it easy to install make the plastic lines simple to repair. A new section of pipe can be spliced into the line quickly; or, if the hole is small, it can be repaired by simply attaching a plastic half sole over the hole with acetate solvent.

Another advantage of plastic pipe is its greater gas carrying capacity. Because its smooth interior finish creates less friction, a 2-in. plastic gas pipe can carry almost as much gas as can a 2½-in. steel pipe. The plastic pipe is manufactured with the same outside dimensions as steel pipe to allow for normal transition from plastic to steel, using compression couplings.

While the working pressure in the seven distribution systems will not exceed 10 psi, the jointed PVC pipe is tested at 50 psi for 24 hours. Pipe used is designed to carry more than 100 psi of pressure.

Every utility can compile different figures on the savings possible with plastic gas distribution systems but all apparently agree that plastic is less costly than steel. The pipe costs less to buy, it can be installed more quickly with fewer workmen, and there's little needed in the way of special equipment or transportation. Peoples' experience thus far has been that this saving on investment is about 30% of the cost of installing steel gas lines. Another utility has estimated this overall saving at 21.5%.

Peoples' experience in the operation of PVC plastic natural gas distribution systems is much too brief to provide any factual information on how maintenance costs of the plastic systems will compare with the welded steel systems. Other gas utilities, with as much as ten years of experience with plastic pipe, are generally satisfied with the operating performance of plastic.

Peoples' engineers borrowed from the experience of others in an attempt to solve in advance some of the special problems connected with the installation of PVC pipe. The Northern Plains' extreme variations in temperature are one of those special problems. PVC expands in hot weather and contracts in cold weather considerably more than steel.

To keep this expansion and contraction from placing too much stress on pipe joints and service take-offs, Peoples' workmen have snaked the PVC plastic pipe into the trenches. The curves in the pipe will provide slack enough to keep pressure off the joints and service take-offs.

Installation of plastic pipe also calls for added care in packing dirt under the service line take-offs before backfilling.

Another difficulty presented by plastic pipe is that, once buried, it cannot be detected with a pipe locater. Some utilities have solved this problem by burying a copper wire with the plastic pipe. Peoples' engineers will depend upon more accurate location measurements to locate mains when new taps are to be made.

The PVC plastic pipe used in the seven Peoples' installations was manufactured by the Kraloy Plastic Pipe Company of Santa Ana, California. Valve tees used in the systems were manufactured by the Mueller Company of Decatur, Illinois.

Peoples' engineers do not consider their installation of plastic pipe natural gas distribution systems experimental. Other utilities have successfully operated plastic gas systems in similar climates for more than 10 years. However, they do consider installation of plastic pipe a potentially right step in the direction of more economical natural gas distribution. A 30% saving on initial investment is significant in itself and the engineers do not anticipate any greater maintenance costs than they would experience with the same seven distribution systems if the pipe were made of steel. ★ ★ ★

How To Simplify Work

Robley D. Stevens,
Management Consultant

There is always a better way of doing the job. Obviously, better methods, improved tools, easier working conditions, and shorter procedures can be discovered when management and employees pool their efforts. Work-simplification makes these better methods apparent — It is a management tool for identifying and eliminating uneconomical use of time, equipment, material, space, and human effort.

Work-simplification also helps solve company problems such as bottlenecks, low output, red tape, backlogs, overtime, and low morale. An action program that pays big dividends, it is aimed directly at the supervisor by equipping him with skill and "know-how" to analyze and improve existing company methods and procedures.

Work-simplification principles and procedures are simple in nature and can be readily learned and employed. Every supervisor in your company should be taught to gather relevant facts quickly, organize them into simple chart form, and interpret them accurately.

Work-simplification is not a single shot in the arm, supervisors can continue to use the method to solve everyday work problems.

Once the supervisor has mastered the use of work-simplification techniques, he should be expected to apply them effectively to the work.

For example, the growing volume and complexity of paperwork is important to control. Management is concerned with the large amount of time and clerical effort required to get productive work done effectively. Work-simplification is one way to help supervisors handle paperwork problems, and get employees to think about better ways to increase their productivity and cut costs.

The supervisor, usually, is the one individual constantly faced with the realities of running a department. Much of the paperwork revolves around his desk. He must know company work requirements and problems at first hand: He is, therefore, in a good position to develop improvements and get action on improvements after they are developed. He is in a good position to use the following techniques:

1. The Work-distribution chart (see figure 1) shows a company's division of work. It helps management ask and get answers to: *What activities take the most time? Is there any misdirected effort? Are employees' skill being used properly? Are employees doing too many unrelated tasks? Are the tasks spread too thin? Is the work distributed evenly?*

A work-distribution chart is the easiest and perhaps best way to arrange these facts in simple form. Properly made, the chart will help management determine if the largest total time of the employee is devoted to the major functions of the company? And it forms the basis for additional work-improvement effort.

Information needed for filling in the work-distribution chart is obtained from the **task-list chart** *(see figure 2)*. Tasks should be listed in order of their importance. Management should get the employee to describe his work as he sees it.

Work-distribution Chart

Department — Date of chart
Existing method — Recommended method
Supervisor

Activity	Total Manhours	Employee A	Man-hours	Employee B	Man-hours	Employee C	Man-hours

Fig. 1.

Employee Task-list Chart

Department — Date
Job Title — Employee Name
Task Number — Activity
Pay Grade — Hours per week
Supervisor

List each specific task you actually do. List all things that you do during regular workweek. Be brief. Number each task separately. Enter average number of hours per week spent on each task. Add number of hours per week for each task and enter total hours worked weekly.

Fig. 2.

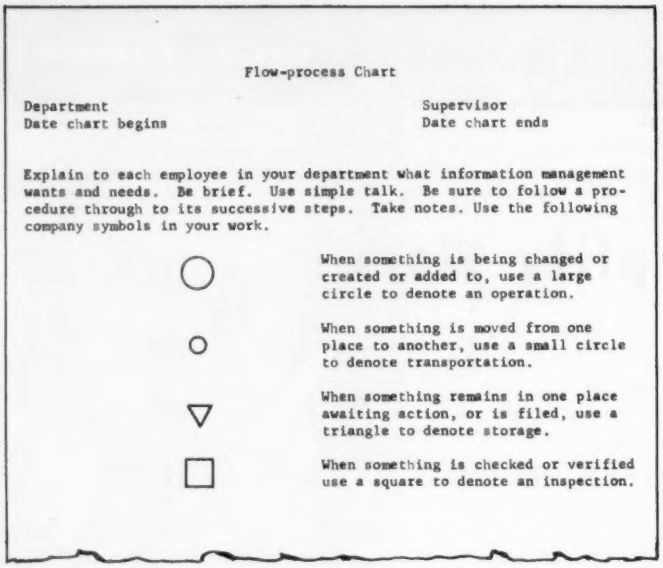

Flow-process Chart
Department
Date chart begins
Supervisor
Date chart ends
Explain to each employee in your department what information management wants and needs. Be brief. Use simple talk. Be sure to follow a procedure through to its successive steps. Take notes. Use the following company symbols in your work.
When something is being changed or created or added to, use a large circle to denote an operation.
When something is moved from one place to another, use a small circle to denote transportation.
When something remains in one place awaiting action, or is filed, use a triangle to denote storage.
When something is checked or verified use a square to denote an inspection.

Fig. 3.

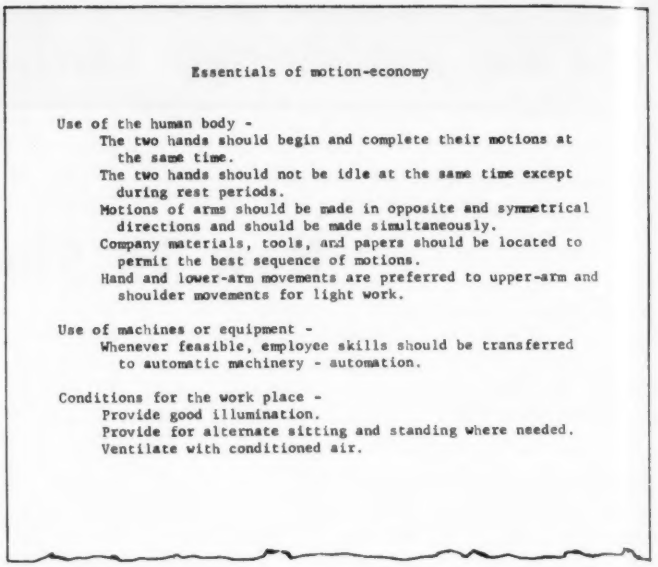

Essentials of motion-economy
Use of the human body -
The two hands should begin and complete their motions at the same time.
The two hands should not be idle at the same time except during rest periods.
Motions of arms should be made in opposite and symmetrical directions and should be made simultaneously.
Company materials, tools, and papers should be located to permit the best sequence of motions.
Hand and lower-arm movements are preferred to upper-arm and shoulder movements for light work.
Use of machines or equipment -
Whenever feasible, employee skills should be transferred to automatic machinery - automation.
Conditions for the work place -
Provide good illumination.
Provide for alternate sitting and standing where needed.
Ventilate with conditioned air.

Fig. 4.

2. The Flow-process chart *(see figure 3)* provides a quick visual analysis of the job. It shows the sequence of work and enables management to trace the work step-by-step. It helps management ask and get an answer to: *What is done? Why is this step necessary? Where should this step be done? Can it be done easier? Who should do the job? Is the right person handling it? How is the job being done?*

The flow-process chart breaks the complicated job process down into a series of basic, simple operations and serves to focus attention on one thing at a time. The supervisor should chart one thing at a time and follow it through. Every process in your company has to start somewhere and finish somewhere. A process is a picture of a procedure.

3. The study of motion-economy shows how to produce the best results with the least amount of physical effort by the employee. It is not a speedup but an elimination of waste motion and nonproductive effort. It shows management how to provide better working conditions, the shortest travel distance for materials, papers, and employees. It is particularly useful in identifying opportunities for the application of management industrial engineering principles.

Motion-economy means doing the things that must be done in the best way and eliminating tasks where cost exceeds the value of the product. The essentials of motion-economy are given in figure 4 for practical use.

By closely studying these essentials of motion and applying them, management should be able to eliminate much lost time and motion by employees, and improve working conditions for better efficiency and economy of operation.

It is always wasteful to have employees working below their skill. Proper use of manpower and employee skill is particularly important today in view of rising costs. Work-simplification will help reduce such costly waste, if management will apply it.

Here's how you can put work-simplification to use to improve working methods:

A. Select a job to be improved and consider cost, time, and workload.

B. Study how it is being done by making a flow-process chart, describing each step, and apply the symbols.

C. Question the present method by using the what, where, when, who, why, and how approach.

D. Determine action by eliminating unnecessary work, combine details, and rearrange tasks for better sequence.

E. Simplify work through motion-economy essentials.

F. Solicit employee participation.

G. Never be too busy to find out how to be less busy on the job.

High quality in all aspects of your operation is important today. Emphasis on efficiency at lower costs is essential in a competitive business like the gas industry today.

Another tool to use in the work-simplification program is **the work-count** — which shows the volume of work. It helps management ask and get answers to such questions: *How much? How many vouchers are prepared per day, how many letters are typed in the stenographic pool per day, how many purchase orders are issued each week, etc.?*

The work-count is useful in such studies as it helps managers determine the relative merits of various methods of doing the work. It also helps to balance the staff and facilities against the workload. By knowing the volume of the various types of work, it is possible to make assignments to departments and individuals in such a way as to enable them to operate at or near capacity.

Efficiency of a company is not measured by the total number of employees assigned but by the number of individuals whose skills are being utilized fully to accomplish the job.

You can see, therefore, that work-measurement is a system of establishing an equitable relationship between the volume of work performed and the employee time expended in doing that volume.

Management should be continually informed about all of the operations and activities of the company. It should ask itself these questions: Is volume of work undertaken needed to achieve our purposes? Is volume of work undertaken being done on schedule? Are the results produced, the results desired? Is work-simplification being used? Wouldn't it help?

Like a suggestion-system, a work-simplification program is one for improving productivity, reducing costs, and increasing employee efficiency. Try it now and see how well it works out in your company. ★ ★ ★

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Breaking pavement in preparation for large bellhole (left), Minneapolis Gas Company crews use hydraulic powered paving breaker. Note barricading of job site for crew's safety. Bellhole is to be dug to reach cast iron main in preparation for internal coating of joints.

Backfilling bellhole on opposite side of street, new "Dynahoe" unit exemplifies versatility of backhoe-loader-wheel tractor equipment used in gas distribution construction. Joint coating project on Minnegasco C. I. mains utilized Fuelling Method.

Distribution Developments

NEWS ABOUT CURRENT AND PLANNED CONSTRUCTION

Illinois Power Company, Decatur, Illinois, will be able to proceed with plans for a new distribution system in Ogden, Illinois, once FPC approval has been given to supplier Trunkline Gas Company's application, CP 62-45. Approximately $101,470 will be spent by Trunkline and Illinois Power with $12,000 going for the measuring and regulating station and $89,470 for the distribution system by the third year. Project involves installation of 1.8 miles of 2-in. lateral at cost $21,090; 800 ft of 2-in. distribution main, ($2450) and 14,100 ft of 1¼-in. main at cost of $35,700. Cathodic protection will cost approximately $700, a regulator station $2200, and customer services another $24,170.

Consumers Power Company, Jackson, Michigan, plans to spend approximately $478,600 to construct two new distribution systems in Bath, Clinton County, Mich. and Stockbridge, Ingham County and enlarge an existing distribution system in Lake City, Missaukee County. Supplier, Michigan Gas Storage Co., has filed for FPC authorization to establish new delivery points at an estimated cost of $40,000, of which $18,000 will be spent in Stockbridge, $19,000 in Bath, and $3000 to enlarge the McBain meter station in Lake City. Consumers plans to install 66,449 ft of 4-in. supply main in Stockbridge and Lake City for approximately $48,154 and $101,376 respectively. A total of 99,577 ft of 2 to 4 in. distribution mains will be installed in the 3 cities at an estimated cost of $126,746. Total cost of each distribution system is estimated at $69,000 for Bath, $160,742 for Stockbridge, and $248,817 in Lake City.

Village of Provencal, Louisiana, a new municipal corporation, has asked the FPC to direct Tennessee Gas Transmission Co. to serve natural gas to facilities to be installed by the Village. Approximately $115,000 will be spent for the new system with $76,795 going for direct construction costs, the remainder for engineering legal, escrowed interest etc. Planned is installation of 21,000 ft of 3-in. wrapped steel pipe at a cost of $29,610, 18,800 ft of 2-in. (16,732); 13,100 ft of 1-in. ($8515) and 6400 ft of ¾-in. pipe ($3840). Approximately $13,018 is tabbed for 222 service assemblies of different sizes. Another $900 goes for two regulator stations; another $900 for one odorizer assembly. Barnard and Burke Inc., Baton Rouge, Louisiana, are engineers for the project.

Arkansas-Missouri Power Company, Blytheville, Arkansas, is seeking FPC okay to lease, acquire at its option and operate natural gas transmission and related facilities to provide natural gas service to communities of Caraway, Black Oak, Lake City, in Craighead County and Marmaduke, Greene County, Ark. Communities will construct and own the facilities from the border station at Monette, Craighead County; Ark-Missouri will enter into a 20-year lease covering the facilities. Approximately $251,000 will be spent for supply lines; $182,500 for the 4 distribution systems, with $57,220 allocated for Caraway; $23,320 for Black Oak, $51,960 for Lake City, and $50,000 for Marmaduke. Construction details are: In Caraway, 4800 ft of 3-in., 6200 ft of 2-in., 8000 ft of 1¼-in. main will be installed at a cost of $19,700. Approximately 245 meters, regulators, curb services also will be installed. In Black Oak, 4500 ft of 2-in., and 3500 ft of 1¼ in. main will be installed at cost of $7750; approximately 80 meters, regulators, and curb services installed. In Lake City, approximately 10,000 ft of 2-in. and 7500 ft of 1¼-in. will be installed at cost of $17,000; 217 meters, regulators and curb services will be installed. In Marmaduke, 1000 ft of 3-in.; 9000 ft of 2-in. and 9000 ft of 1¼ in. will be installed at cost of $18,450; 202 meters will be installed.

Indiana Gas & Water Company, Inc., Indianapolis, Indiana, reports contractor crews working on distribution construction projects totaling $442,790. In Brooklyn, Indiana, approximately 20,000 ft of 2-in., 600 ft of 3-in., and 1320 ft of 4-in. intermediate pressure mains are being installed by Gallatin, Inc., contractor, for approximately $41,202. In Greenwood, Ind., 62,265 ft of 2-in., 12,665 ft of 3-in., 27,140 ft of 4-in., and 21,865 ft of 6-in. IP mains are being installed by McGuire Pipeline Construction Co., contractor, for $261,749. In Whiteland, Indiana, a $63,693 distribution system including 23,860 ft of 2-in., 1850 ft of 3-in., 3940 ft of 4-in. and 2730 ft of 6-in. is being installed by Gallatin, Inc. Gallatin also has contract for installation of 32,205 ft of 2-in., 1440 ft of 3-in., 7480 ft of 4-in., and 1785 ft of 6-in. in New Whiteland, Ind. Work in both projects began in March 1961.

Lowell Gas Company, Lowell, Massachusetts, will spend approximately $5,419,464 in 1961 on new distribution construction. Major projects accounting for 75% of the total budget include a $132,000 installation of 3800 ft of 6-in. and 15,600 ft of 8-in. in Chelmsford and Billerica to reinforce existing system and provide peak shaving. In Chelmsford several projects are listed, all to serve new customers. Work is to be contracted. Approximately 1200 ft of 3-in.; 2400 ft of 2-in. main are to be installed at cost of $17,500; 6900 ft of 4-in. and 3200 ft of 2-in. at cost of $49,500; 1400 ft of 4-in. and 500 ft of 2-in. at cost of $10,700; 5200 ft of 2-in. as cost of $19,600; 3600 ft of 3-in., 700 ft of 2-in. at a cost of $18,800; 2800 ft of 2-in. at cost of $11,300; 3200 ft of 4-in. low pressure main at cost of $22,400; and 800 ft of 4-in., 1200 ft of 3-in. and 4800 ft of 2-in. at a cost of $54,700.

In Billerica, 3000 ft of 4-in. and 6200 ft of 2-in. HP main will be installed at cost of $43,400. In Wilmington, 400 ft of 4-in. and 2800 ft of 2-in. to serve new customers will be installed at cost of $16,400. Also in Wilmington in another project, 3800 ft of 4-in. and 300 ft of 2-in. will be installed at cost of $30,000. In Lowell, two projects are scheduled — a $10,300 project to install 2000 ft of 2-in. HP main to serve new customers and another $35,900 project for relocation of existing mains due to new highway that involves 1200 ft of 16-in. LP and 1200 ft of 12-in. LP mains. In Dracut, company plans to install 2000 ft of 8-in. and 3300 ft of 2 in. at cost of $31,000 and 3000 ft of 2-in. at cost of $12,400 to serve new customers.

The Gas Service Company, Kansas City, Missouri, plans to initiate service in Nixa, Missouri, and Arma and Alden, Kansas. Supplier, Cities Service Gas Co. of Oklahoma City, Oklahoma, recently filed two applications with the FPC for authorization to sell gas to Gas Service for resale in these communities. Approximately $67,547 is estimated as cost to serve 280 domestic customers in Nixa distribution system, another $150,000 to serve 712 customers by the 3rd year in Arma, and another $50,000 for the Alden distribution system. Cost of the supply laterals is set at $3530 for the 4.5 mile 6-in. lateral to Arma (existing Ozark lateral will serve Nixa), and $3400 for the tap on Cities Service 16-in. line and construction of meter and regulator equipment in Rice County, Kansas, to serve Alden, Kansas.

Pacific Gas and Electric Company, San Francisco, California, has construction underway on projects totalling $1,069,000 and is anticipating another $991,000 project in Redding pending California PUC approval. All construction underway is being done by company forces and will be completed by Dec. 31, 1961. Major projects include installation of 15,000 ft of 12-in. HP line for distribution reinforcement in Lafayette at cost of $216,000. In Union City, 18,000 ft of 12-in. HP main is being installed to supply gas to Pacific Steel Co. at a cost of $218,000. Approximately 42,000 ft of 4, 8, and 10-in. HP main is being laid from Arcata to McKinleyville to extend gas to new areas; cost is estimated at $300,000. In Camp Beale, 16,000 ft of 4-in. HP main is being installed at cost of $83,000 to serve housing and other facilities. In Bakersfield, 30,000 ft of 10-in. HP main is being installed for distribution reinforcement at a cost of $252,000. The Redding project, largest single project noted, involves installation of 222,000 ft of 6, 8, 10 and 12-in. HP mains to supply the Calaveras Cement plant from a 36-in. Canadian line. Cost is estimated at $991,000. Work will be done by contractor with completion date tentatively set at July 1962, pending California PUC approval.

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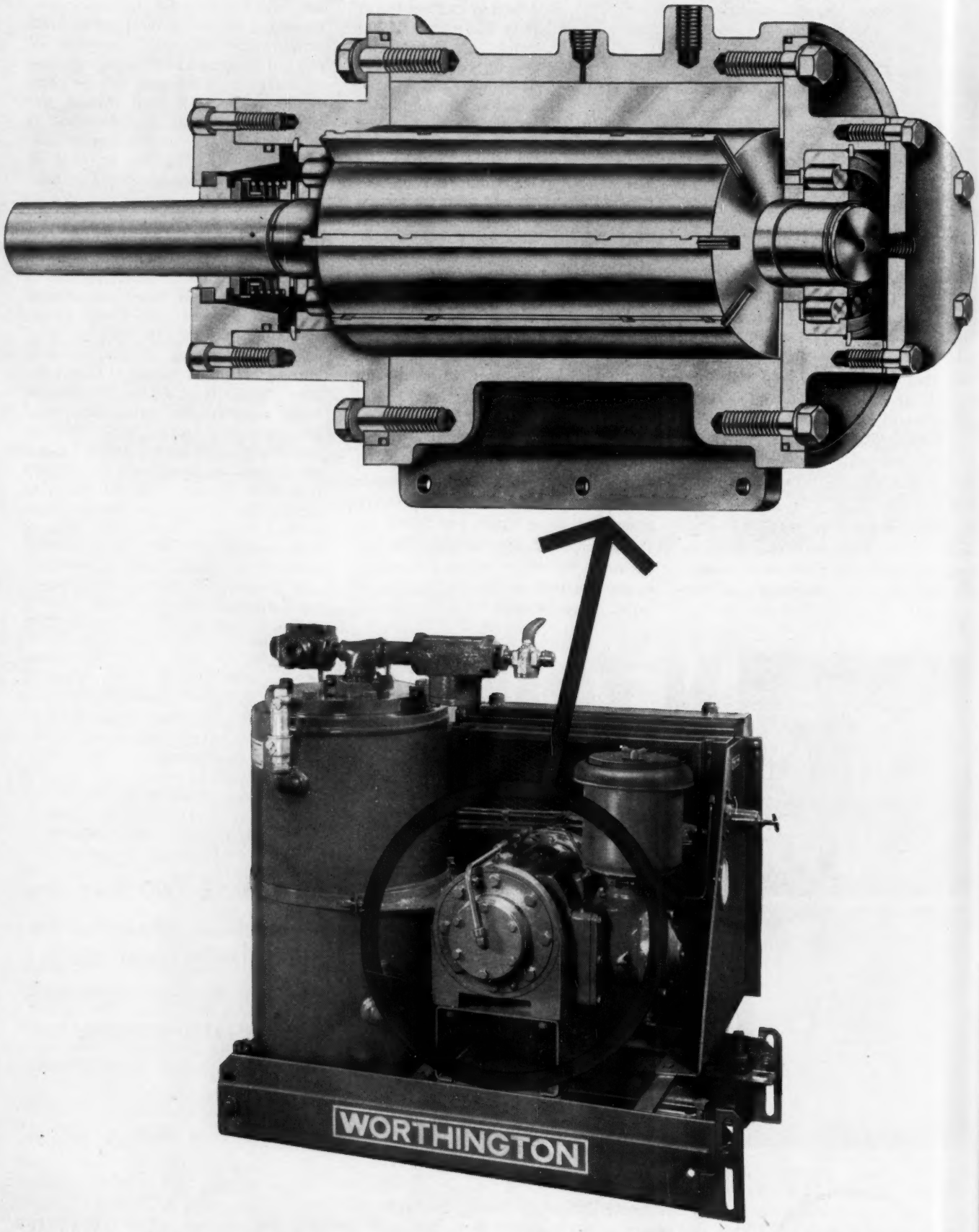

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The new Mono-Rotor compressor has many other advantages for utilities in addition to its extreme dependability. For example, Worthington design refinements over the last 5 years has produced for utilities the packaged unit shown at left. It is the lightest weight, most compact compressor unit available today—from 100 pounds to 800 pounds lighter than comparable units. It saves weight and provides additional space in the truck for tools, equipment and supplies.

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What about price? For both 85′ and 125′ models we believe that it will be the most attractive you'll find. And don't forget the added value of the new one year warranty.

But proof of the Mono-Rotor value lies in its performance. Ask about a possible demonstration or trial. To get fast response send the coupon shown here. Worthington Corporation, Holyoke, Mass. In Canada, Worthington (Canada) Ltd., Brantford, Ontario.

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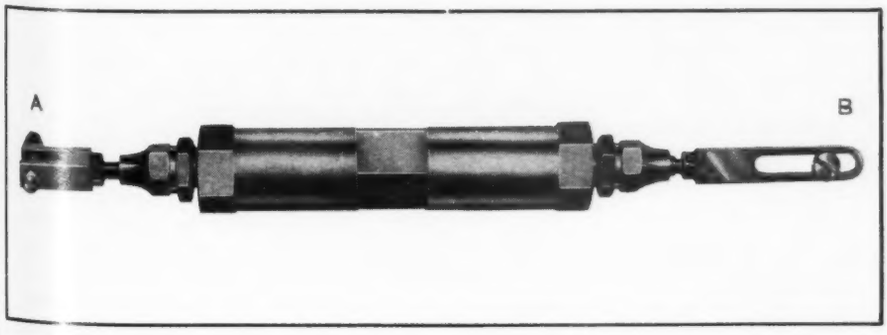

This is the "Drivers Dream" truck engine control. It is pneumatically operated and works directly on the engine carburetor butterfly. No valve box on carburetor—no governor—no dashboard control, just this easily installed cylinder. Piston rod A is the basic control—setting carburetor butterfly for road or compressor operation—automatically. Piston rod B varies engine speed according to air demand during compressor operation.

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- ____ I would like information about separate components for "tailoring" to a truck.
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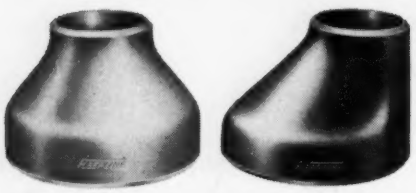

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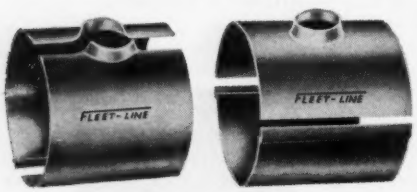

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Distribution Developments

Washington Natural Gas Company, Seattle, Washington, plans to install 2600 ft of 8-in. city gate reinforcements and replacements for $26,000, 2600 ft of 8-in. intermediate pressure replacement main for $20,000, 3000 ft of 12-in. high pressure replacement main for $58,000, and 6200 ft of 8-in. supply main and HP district regulators for $62,000 in the Seattle area. Another $70,000 will be spent for installation of 10,000 ft of 6-in. main for reinforcements and district regulators in the low and intermediate pressure systems in Tacoma.

In Olympia, 18,000 ft of 6-in. HP supply main loop was installed by contractor, Hood Northwest Pipeline Co. at an estimated cost of $93,000. Hood also has completed installation of 29,000 ft of 2, 4, and 6-in. reinforcements, replacements within the city of Chehalis at a cost of $145,000. In other various areas of WNG territory approximately 500,000 ft of new 2, 4, and 6-in. intermediate pressure main extensions will cost $1,000,000. Work is to be completed by Dec. 31 by various contractors.

Long Beach Gas Department, Long Beach, California, estimates its annual gas main and service replacement and repair contract for 1961 with Royal Pipeline Construction Co. of El Monte, California, will cost approximately $450,000 exclusive of material and use approximately 100,000 ft of all pipe sizes. Work started August 1.

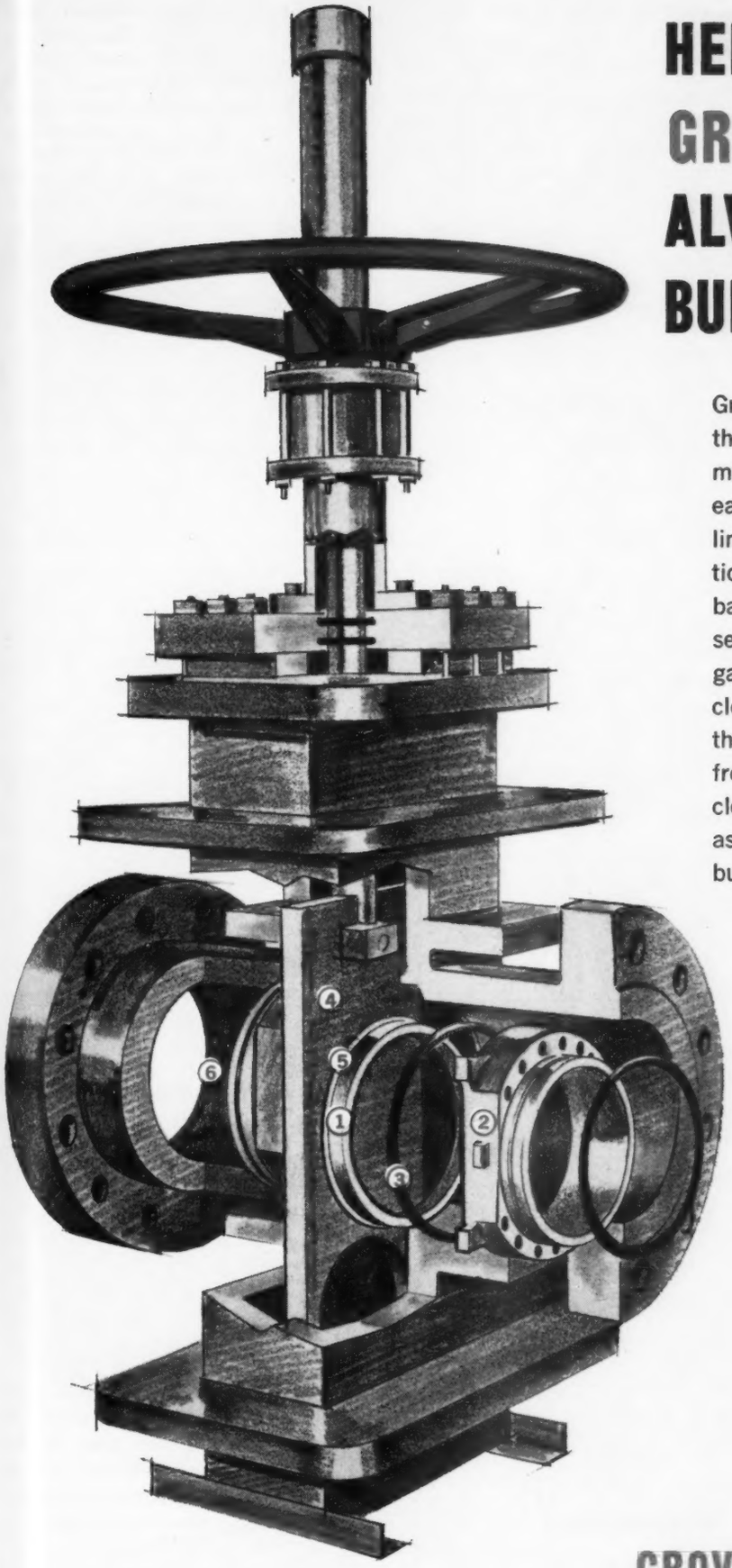
Southern Counties Gas Company, Los Angeles, California, estimates it will spend $10,804,000 in 1961 on distribution construction, of which $9,986,000 will be for new connections and $818,000 will be for reinforcing the present system. Construction in San Luis Obispo, Santa Barbara, Ventura, Los Angeles, and Orange counties, Calif., includes approximately 7,200,000 ft of ¾ to 12-in. pipe to reinforce and add to distribution systems that currently serve over 800,000 connected meters (776,551 active as of June 30, 1961). An addition of approximately 55,000 new connections (about 45,000 net) is anticipated during 1961. Company crews will perform approximately 35 to 40% of the work. Various outside contractors are installing the remainder.

Ohio Gas Company, Bryan, Ohio, is spending $224,100 on distribution construction this year. Wm. F. Swetnam, Inc. has contract to install 21,200 ft of 2-in; 34,600 ft of 4-in. and 3210 ft of 6-in. intermediate pressure mains at a cost of $169,500, and 55,000 ft of ¾-in. services at a cost of $54,600.

Backhoe cuts trench in street for new 16-in. high pressure main in Woodbridge, New Jersey, for Elizabethtown Consolidated Gas Co.

Mountain Fuel Supply Company, Salt Lake City, Utah, has construction projects underway or recently completed totalling $2,192,829. Projects include $567,100 for a 91,900 ft 8, 10, and 12-in. HP feeder main from Brigham City to Tremonton being installed by M. H. Cook Pipeline Construction Co. Project was completed in October. In Tremonton, 55,680 ft of ¾-in. to 6-in. IP distribution mains and services are being installed by Tempest Company, contractor, for an estimated cost of $154,132; and another 54,269 ft of ¾-in. to 6-in. IP mains and services are being installed by Geo. T. Smith Co. contractor, for a cost of $182,197. In the Garland area, approximately 47,225 ft of ¾- to 4-in. IP distribution mains and services are being installed by Tempest Co. for a cost of $125,800. In Honeyville contractor crews of Neiderhauser Lumber & Construction Co. are installing 23,000 ft of ¾- to 2-in. IP distribution mains and services for $45,600. Elsewhere in Utah, contiguous to present service areas of Mountain Fuel, a total of 421,000 ft of ¾ to 6-in. IP distribution mains and services were installed by several contractors at a cost of $1,118,000.

Williamsville Water Co. of Kosciusko, Mississippi, in Attala County, plans to build a $20,000 distribution system to serve Williamsville and rural customers. Supplier, United Gas Pipe Line Co., recently filed application with FPC for authority to construct and operate a tap and meter to serve the new customer. United will construct approximately 40 ft of 2-in. supply lateral and meter station at cost of $412 for pipe; $2374 for meter station materials; $899 for installation of pipe and meter station, etc., or a total of $4038.



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Distribution Developments

Milwaukee Gas Light Company, Milwaukee, Wisc., has applied for state PSC authority to spend $140,300 over a 5-year period to extend natural gas service to Marshall. Company predicts having approximately 255 customers at end of that time.

Kansas Power and Light Company, Salina, Kansas, recently completed a $10,000 new intermediate pressure (5 to 10 psi) distribution system to serve 70 customers in Nashville, Kansas. All work was done by company crews. Approximately 320 ft of 4-in., 3450 ft of 2-in., and 7210 ft of 1¼-in. mains and services were installed.

City of Bamberg, South Carolina, plans to construct a $225,000 natural gas distribution system. Consulting engineers are Owen & White of Baton Rouge, La.

City of Sylvester, Georgia, recently secured approval from city voters for $272,000 in bonds to finance a natural gas distribution system. Goodwin Engineers of the South, Inc. of Birmingham, Alabama, are consulting engineers.

Long Island Lighting Company, Mineola, L. I., New York, has company crews working in Glenwood Landing, L. I. on a $350,000 project to install a 1500-hp electric motor driven booster compressor with 100 psi suction, and 350 psi discharge. Work is to be completed in November. Company crews are also installing 34,000 ft of 8-in. (350 psig) HP main in Smithtown, L. I. Cost is estimated at $410,000.

Elizabethtown Consolidated Gas Company, Elizabeth, New Jersey, plans to spend more than $1,860,000 in new construction this year. Major projects include installation of 8600 ft of 16-in. high pressure steel main to reinforce the Southern Division Carteret section in Woodbridge at a cost of $150,000, work is to be completed in November. In Elizabeth, a $120,000, 5400 ft 12-in. main was installed in September to tie in new gate station with existing system. Contractor crews of Continental Construction Co. of New Brunswick, N. J., recently completed a third major project—a $80,000, 4200 ft 16-in. HP steel main to tie in two gate stations in St. George's Avenue, Woodbridge.

During the year, company-wide programs scheduled include installation of 190,000 ft of 2 to 10-in. intermediate pressure and low pressure steel main at a cost of $950,000. Work is to be done 20% by company crews; 80% by contract. Approximately 42,000 ft of 4 to 12-in. IP and LP cast iron main will be installed this year at a cost of $300,000 with work being done on a 20%:80% ratio also. General program of installing IP and LP steel services includes 50,000 ft of 1 to 4-in. at a cost of $140,000 with work being done on a 10%: 90% contractor ratio. Copper service renewal program involves installation of 85,000 ft of ½ to 1½ in. pipe at a cost of $120,000; work is to be done on a 5% company, 95% contractor ratio.

Town of Social Circle, Georgia, plans to construct a $157,540 natural gas distribution system. Consulting engineers are Tribble & Associates, Inc. of Macon, Georgia.

City of Charlottesville, Virginia, plans to spend approximately $180,000 to augment its gas supply lines. Of this total, approximately $80,000 will go for gas mains in the Rutledge area and $100,000 for a peak shaving plant.

Missouri Utilities Company, Cape Girardeau, Mo., plans to install a 3.6 mile, 10-in. high pressure natural gas supply line in the western part of the city of Cape Girardeau. Cost is estimated at $115,075.

New High-Performance

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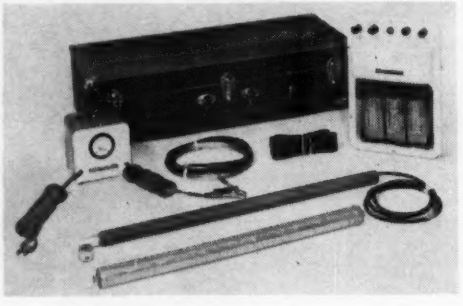
HOLIDAY DETECTOR

Weighs Only 9 POUNDS Including Battery



Little Jeeper Detector Kit includes: **Battery Charger,** 110 v. 4-amp. with ammeter & circuit breaker • **Ground Cable,** 30 ft., 6-ft. rubber sleeve protects operator • **Battery,** spillproof, rechargeable • **Electrode Connector & Handle** • **Spring Electrode** • **Weatherproof Shipping Case.**

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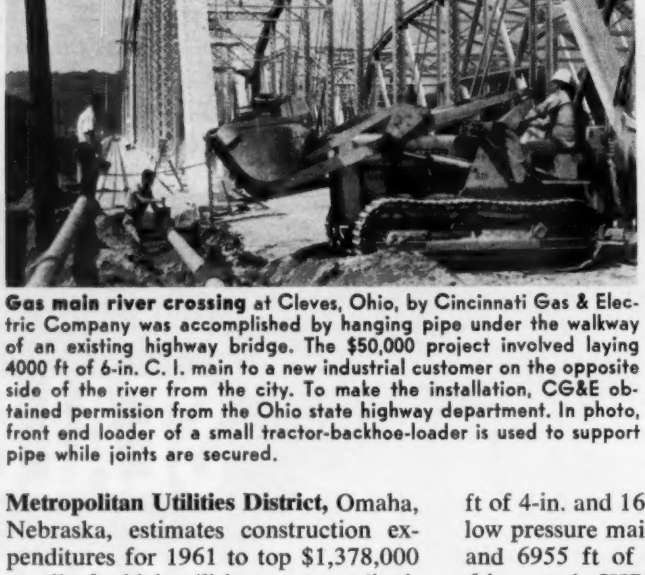
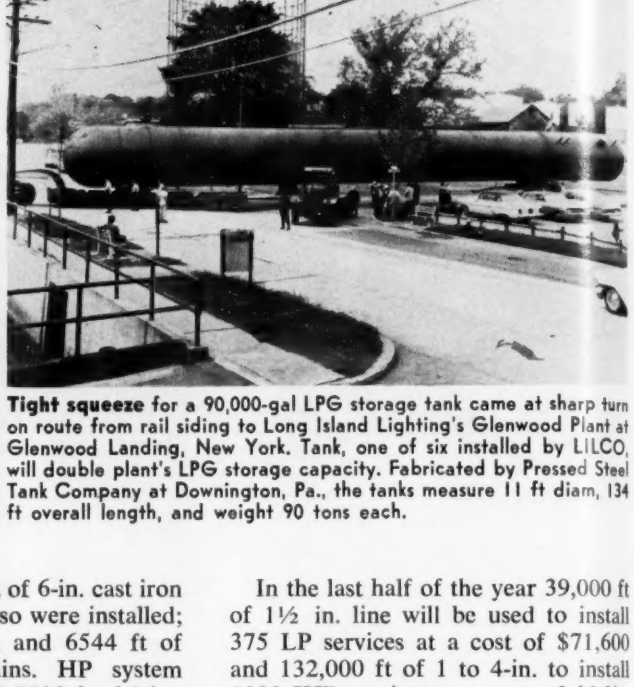
Distribution Developments



Gas main river crossing at Cleves, Ohio, by Cincinnati Gas & Electric Company was accomplished by hanging pipe under the walkway of an existing highway bridge. The $50,000 project involved laying 4000 ft of 6-in. C. I. main to a new industrial customer on the opposite side of the river from the city. To make the installation, CG&E obtained permission from the Ohio state highway department. In photo, front end loader of a small tractor-backhoe-loader is used to support pipe while joints are secured.



Tight squeeze for a 90,000-gal LPG storage tank came at sharp turn on route from rail siding to Long Island Lighting's Glenwood Plant at Glenwood Landing, New York. Tank, one of six installed by LILCO, will double plant's LPG storage capacity. Fabricated by Pressed Steel Tank Company at Downington, Pa., the tanks measure 11 ft diam, 134 ft overall length, and weight 90 tons each.

Metropolitan Utilities District, Omaha, Nebraska, estimates construction expenditures for 1961 to top $1,378,000 — all of which will be spent on distribution construction within the City of Omaha. All work being done by company crews. Approximately $329,000 was spent in the Jan.-July period to install 4317 ft of 1¼ in., 93,513 ft of 2-in., and 9016 ft of 3-in. steel intermediate high pressure residential distribution mains. Approximately 5744 ft of 4-in. and 1645 ft of 6-in. cast iron low pressure mains also were installed; and 6955 ft of 4-in. and 6544 ft of 6-in. steel IHP mains. HP system feeder mains laid used 7703 ft of 8-in., 4049 ft of 12-in.; 1236 ft of 16-in. and 398 ft of 24-in. steel pipe. Services for the first half of the year accounted for 27,750 ft of 1½-in. for 345 LP services at a cost of $66,200 and another 104,410 ft of 1 to 4-in. line to install 1402 IHP services at a cost of $195,000.

In the last half of the year 39,000 ft of 1½ in. line will be used to install 375 LP services at a cost of $71,600 and 132,000 ft of 1 to 4-in. to install 1880 IHP services at a cost of $263,200. During the Aug.-Dec. 31 period approximately $453,000 will be spent to install 3555 ft of 1¼-in., 92,720 ft of 2-in., 11,205 ft of 3-in., 15,740 ft of 4-in., 8,190 ft of 6-in. and 1700 ft of 8-in. steel IHP system feeder and residential distribution mains.

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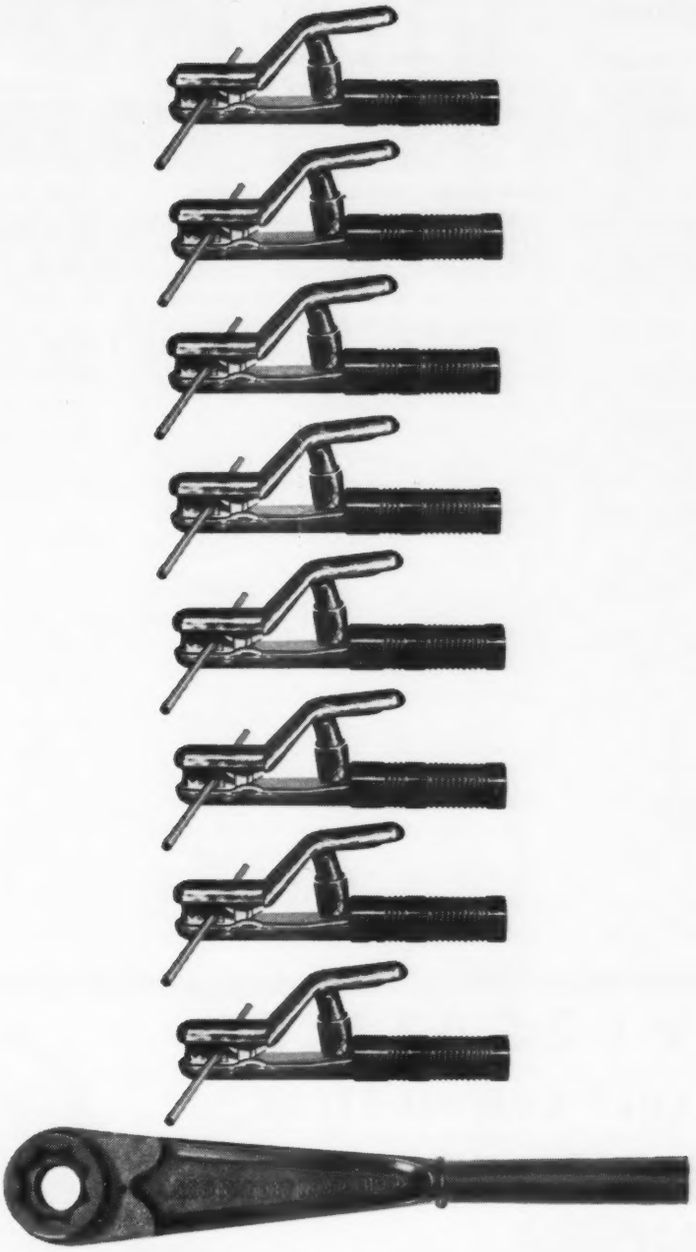

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Distribution Developments

Wisconsin Natural Gas Company, Racine, Wisc. plans to use $1,500,000 raised by sale of a $2,500,000 stock issue recently approved by the state PSC to pay for continuing gas expansion in the Racine-Kenosha area. Balance of the stock issue will be used as dividends on WNG stock already held by its parent organization, Wisconsin Electric Power Co. WNG was also granted authority by the PSC to construct a main in the town of Cold Spring, located southeast of Jefferson.

Ohio Fuel Gas Company, Columbus, Ohio, has announced plans for a new $155,000 operating center southwest of Mt. Vernon, Ohio, to replace present center on S. Mulberry St. in Mt. Vernon. Stewart Construction Co. of Marion has the contract; work is expected to be completed next spring.

Work is underway and expected to be completed in December on a $51,500 construction project to extend gas service to Flechtner Heights, north of Fostoria. More than 3 miles of 2, 3, and 4-in. line are being laid. New regulator station is to be built at intersection of Buckman Rd. and State Route 99. Don Miller, Inc., Green Springs, Ohio, is the contractor.

Construction is also underway on a $453,300 project to deliver more gas to north Columbus, Upper Arlington, Worthington and Hillard. Approximately 6 miles of 20-in. line is being laid north. Line crosses 2 streams, and extends under 8 major traffic arteries. Ohio Pipeline Construction Co. of Newark, contractor, expects to complete project about mid-December.

A $37,900 project to extend gas service to the Village of Nankin, four miles north of Ashland on State Routes 302 and 58 involves installation of 2 miles of 1¼, 2, 3, and 4-in. pipe. New regulator station is to be built at southern end of new line. Wirt & Starn Inc. of Wooster is contractor.

Ohio Fuel has asked PUC for authority to take over gas service to 330 customers in and near Holland, Lucas County, Ohio, as the result of a sale of the property by Ohio Gas to Ohio Fuel for approximately $215,000.

Work is underway on a $38,000 project to improve service in Avon and Sheffield that involves installation of a new measuring station on Abbe Rd. about midway between Campagna and Cleveland Western roads. Don Miller, Inc. is contractor.

Also underway is a $196,000 pipeline replacement project in Perry and Muskingum Counties to deliver more gas to Cambridge and Zanesville. Approximately 4½ miles of 12-in. line will be laid and will replace a section of smaller diameter line that supplies Zanesville and Cambridge areas. Central Pipelines Co. of Lima, contractor, expects completion this month.

Construction projects recently completed include a $52,800 extension to serve Edgefield Farms Addition southeast of Millbury on State Route 51. More than 3½ miles of 1¼, 2, and 3-in. line was laid. A new regulator station was also built adjacent to Woodville Rd. Burkhardt Construction Co. of Avon was the contractor.

A $52,600 project to extend gas service to the Village of Kipton, southwest of Oberlin in Lorain County involved laying of 5 miles of 1¼ and 2-in. lines. New regulator station was built near Vermilion Rd. Don Miller, Inc. contractor, completed work Nov. 1.

Construction projects totalling $401,475 to deliver more gas to Alliance, Salem, and Waynesburg involved installation of 8.5 miles of 12-in. line, at a cost of $375,000, to replace 5 sections of existing smaller lines, and installation of a new town border station on West Beach Rd. south of Alliance at a cost of $26,475. Central Pipelines Construction Co. of Lima was contractor.

Another project costing $42,100 involved laying more than a mile of 4, 6, and 8-in. and new regulator station line to deliver more gas to Northridge Addition a mile north of Springfield. Don Miller, Inc. was the contractor.

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CLEANING & TAPE WRAPPING MACHINE

The new Crose cleaning and tape wrapping machine offers a new design and improved mechanical cleaning of pipe with twisted wire wheel type brushes revolving at high speed. Self-compensating brushes are long-wearing and economical to replace. Only one head is used, but a counter rotating effect is employed by rotation of the cleaning sprocket and an opposite rotation of wire brushes. Lower fuel consumption, less weight than comparable conventional machines. Can quickly be adjusted from one pipe size to another throughout range of machine. Handles pipe from 3″ to 6″.

Centrifugally loaded wheel type brush cleaning head

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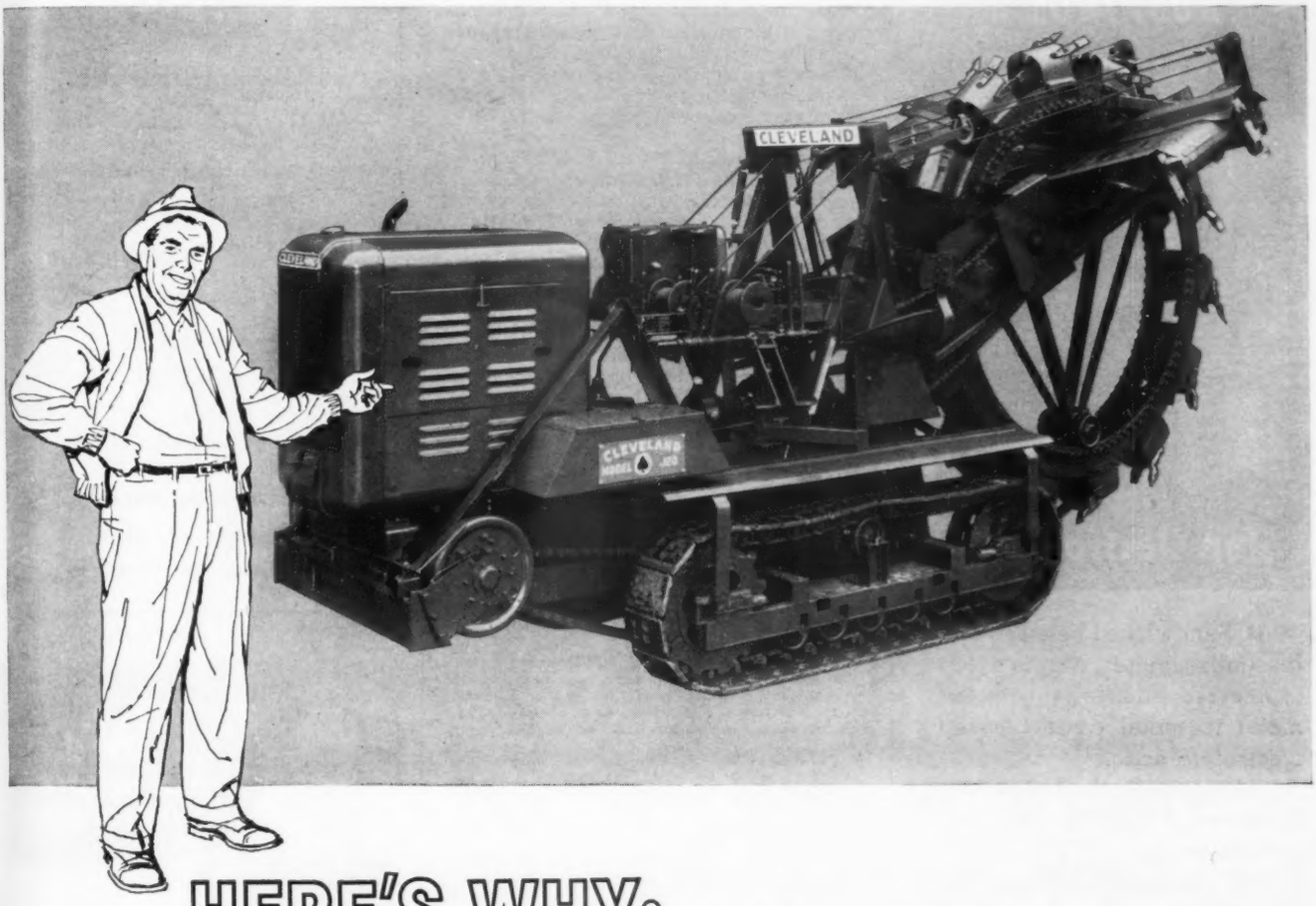
FOR DISTRIBUTION TRENCHING



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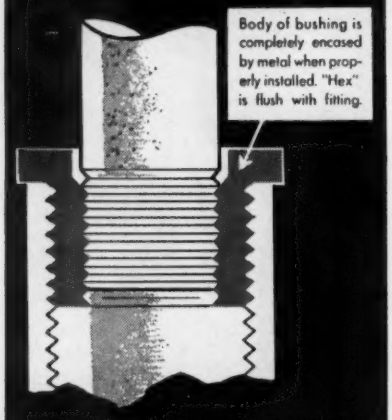

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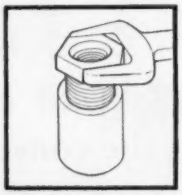

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Bookshelf

The Marketing Job, *edited by Elizabeth Marting. Published by the American Management Association, 1515 Broadway, New York 36, New York; 448 pages, $9.00 (AMA members, $6.00).*

Importance of the role industrial management plays on the management level is evaluated in this symposium of the views and experiences of 47 marketing executives and specialists. Chapter headings cover different aspects of the total job, from participation in policy making, product planning, scheduling and pricing, to selling, servicing products and dealing with the public. Marketing research, economic forecasting and periodic marketing audits are stressed also.

Record Houses of 1961, *edited by editors of Architectural Record. Published by F. W. Dodge Corporation's Architectural Record, 119 West 40th Street, New York 18, New York. Pages, 180.*

Twenty of the year's finest architect-designed houses are shown in 185 photographs, plans, and drawings in *Architectural Record's* 6th annual Record Houses presentation. The editors have selected what seem to them most outstanding houses over a broad range of family requirements, cost and geography. In addition to case histories of the 20 award-winning houses, articles on technical developments and costs also have been included.

Statement Required by the Act of August 24, 1912, as Amended by the Acts of March 3, 1933, July 2, 1946 and June 11, 1960 (74 Stat. 208) Showing the Ownership, Management, and Circulation of

AMERICAN GAS JOURNAL

Published monthly except semi-monthly in August, at Dallas, Texas for October 1, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher: The Petroleum Engineer Publishing Co., 800 Davis Bldg., Dallas, Texas.

Editor: Dean Hale, 800 Davis Bldg., Dallas, Texas.

Business Manager: Joe B. Woods, 800 Davis Bldg., Dallas, Texas.

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The Petroleum Engineer Publishing Company, 800 Davis Bldg., Dallas, Texas.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)

None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 8,062.

Joe B. Woods, Business Manager.

Sworn to and subscribed before me this 28th day of September, 1961.

(SEAL) Lillian H. Johnston
Notary Public, Dallas County,
(My commission expires June 1, 1963)

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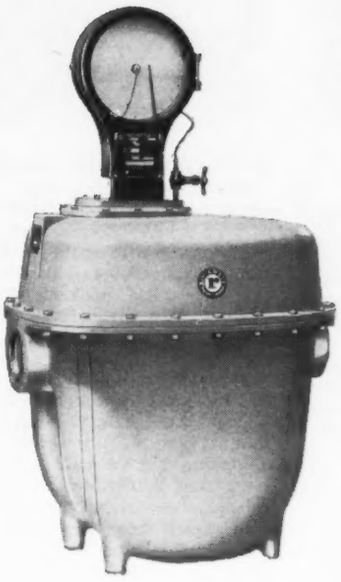

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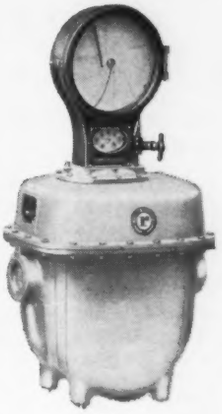

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Rockwell aluminum meters are light in weight—easier to handle and install. Weathering is no problem, neither are the bumps and knocks encountered in the field. Single joint construction means safety—also simplifies access to the inner mechanism which is removable and interchangeable as a unit.

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ALUMINUM GAS METERS
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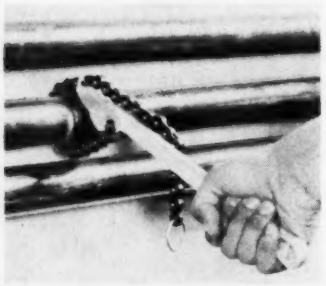
New midget, highly sensitive, electronic leak detector has been announced by The Goldak Company, Inc. The Goldak Model ML-61 can detect all types of leaks under dirt, pavement, concrete, wood and other surfaces with rapid, pin-point accuracy in gas lines under hydrostatic tests. Unit has operating weight of only 20 ounces. Dimensions of the aluminum case housing all electronic parts, including 3 transistors, batteries and circuitry is just 5-in. by 1¾ in. by 2⅛ in. **1**

Specifications of American Series 88 pneumatic controllers, transmitters and receivers are described in new Bulletin 406 published by American Meter Company. Designed to control and transmit flow, pressure, liquid level and other continuous process variables, the instruments incorporate many newly developed features to simplify adjustments, decrease maintenance and provide increased adaptability. Bulletin describes various models and includes cutaway illustrations showing internal design features. Complete descriptions, weights, dimensions and capacities are given. **2**

Personal protective equipment for welding and cutting, is described in 20-page catalog available from the NCG Division of Chemetron Corp. Features are helmets, hand shields, goggles, safety glasses, safety hats and caps, face shields, portable screens, gloves and mittens, and accessories. **3**



New size utility chain wrench, designed to accommodate ⅛ to 4-in. pipe and featuring ratchet-like action in either direction, is now available from Ridge Tool Company. Double jaw construction allows wrench to be operated in either direction without having to remove and refasten it when changing directions. Only ¾-in. clearance is required to apply the wrench, making it especially suitable for limited access applications. **4**

Full information on General Controls Company's complete line of heating controls is presented in a new 98-page catalog now available. Introduced in the catalog are new "Sheer Line" room thermostats offering any combination of features — fixed or adjustable heat anticipation; mercury switch, snap-action or thermopoised contacts; 24-v., millivolt or line voltage models. **5**

Pneumatic analog computer has been developed by The Garrett Corporation's AiResearch Manufacturing Division, Phoenix. APAC (AiResearch Pneumatic Analog Computer) uses standard industry 3-15 psi pneumatic inputs — adds, subtracts, multiplies, divides, takes ratios, square roots, integrates, differentiates, serves as a function or test signal generator, and provides hold or memory. By use of common components assembled in a variety of modules, APAC offers great flexibility at low cost. **6**

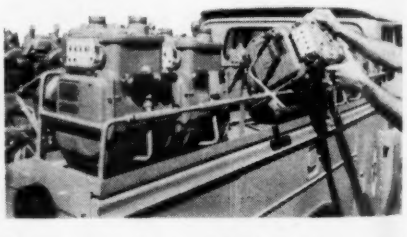
Cold weld pinch-off and sealing device for copper tubing has been announced by Kane Engineering Laboratories. The R-20 pinch-off device handles tubing up to ¼-in. OD by 0.060-in. wall. Hermetically sealed ends are actually fused in a cold weld. Ends are neat and clean. Unit's light weight and compact size — handles are 12-in. long — make it ideal for difficult access situations. Specially hardened jaws may be reconditioned or replaced if necessary. **7**

"How To Select a Pressure-Sensitive Tape" is title of a new booklet published by Johns- Manville Dutch Brand Division. Two-color, 4-page booklet describes types of tapes available, how they are constructed, and the factors involved in choosing a particular tape for a specific application. **8**

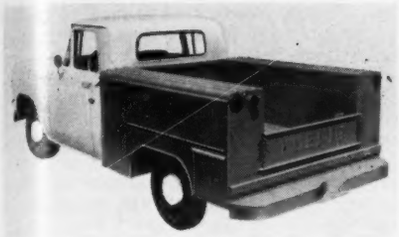
Truck-mounted Grove TM-12 crane unit features 12-ton capacity mounted on a 1066CS Crane Carrier chassis. Boom telescopes hydraulically from 16 to 40-ft under load with a maximum hook clearance of 44 ft from the ground. The turn-table winch, boom operator's station, and counterweight rotate 360 degrees continuously. Operator's station provides full visibility at all times. All movements of the Crane unit are finger-tip controlled by the hydraulic valves at the operator's station. Special attachments include hydraulic clam-shells, jib booms, hydraulic hammers, snow scoops, and others to increase efficiency and broaden use of the machine. Units are also available in 6 ton capacity and may be mounted on any suitable truck chassis. **9**

Quick-disconnect for 30-second coupling, 12-ft., 6-in. digging depth and a direct ejector bucket are features of a new hydraulic backhoe announced by Equipment Division, Young Spring & Wire Corp. for use on Caterpillar wheel loaders. Called the Ottawa LX Backhoe, the unit fits Cat 922 and 944 wheel loaders as well as the 933 traxcavator. Basic concept of the design is tractor-loader versatility. The quick-connect Hydra-Hitch allows the entire backhoe to be attached in 30 seconds by pushing one lever to engage two cone mounting pins and latching quick release. Coupling the quick connect hydraulic lines completes the job. Reversing the process frees the loader for other work. Pickup or release can be handled on rough ground as the mechanism compensates for alignment. A second, standard model features mechanical attachment by one man in 15 minutes. **10**

New infra-red gas burner, designated type "K", has been announced by Red-Ray Manufacturing Co., Inc. Laboratory and field installations indicate high conversion ratio of fuel to infra-red. The type "K" burner is designed to produce the major portion of its radiation in the far infra-red wave lengths above 2.7 microns. Burner is manufactured on 2½, 4½ and 7-in. lengths, which can be mounted end-to-end on a common manifold, providing continuous heat radiators of from 2½-in. to 100-ft. or more. Width of the burner is 6⅝-in. **11**



New gas service truck body with patented B & W Meter and Regulator Rack fits all standard ½, ¾ and 1-ton truck chassis. Over-all height from ground to top of body 46¾-in. Body is 32-in. high, bed is 16-in. deep. Side boxes are 14-in. in depth and equipped with bins for stocking standard gas fitting and tools. All bins are equipped with locks. Low silhouette of body when mounted on the truck's chassis, facilitates the mounting of Meter and Regulator Racks at convenient height. B & W Rack can be furnished Meter only or combination Meter and Regulator Rack. Meter Rack has a quick change adjustment to handle meters up to and including No. 2 Sprague or Equitable tin case. It can be furnished as a single unit, or any number of units required: ½ ton service body normally has 7 units per side; ¾ ton normally has 9 units per side and 1 ton service body normally has 10 units per side. **12**

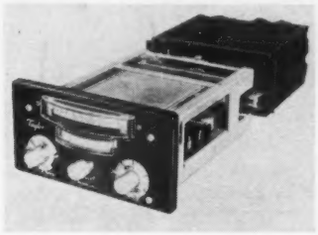


Engineered for "Panoramic visibility" when installed on new wider, lower chassis, Lo-Boy service body for ½ and ¾-ton truck chassis manufactured by Koenig Iron Works, Inc., combines modern streamlining with the efficiency of maximum storage and rugged construction. Designed for all phases of maintenance and service operations, the Lo-Boy offers greater storage space plus improved visibility for the driver. Corrugated tops of the 15-in. wide compartments give greater strength and rigidity to the body. **13**

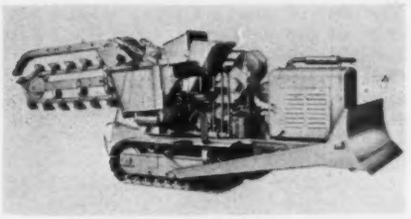
Hand-held Type B transistorized sound survey meter produced by The Korfund Company, Inc., is described in new two-page brochure. The meter, which weighs only 1-lb including battery, is designed for one hand operation, and is invaluable for use in field surveys for locating the source of potentially harmful sound levels, and in preventive maintenance programs. **14**

New bulletin on Selas Duradiant Burners presents a full line of "complete premix" radiant type gas units in successful use throughout industry, covers design features, construction, operating principles and advantages of Duradiant burners, and shows how and where the burners can best be used. **15**

Dynel Division of Varec, Inc., has introduced new line of equipment including custom-made controls, telemetering data gathering systems, supervisory and scanning systems, panel boards and other tailor-made designs. Dynel Division also designs special systems for monitoring and control and produces standard equipment for more economical liquid level and temperature telemetering systems. **16**



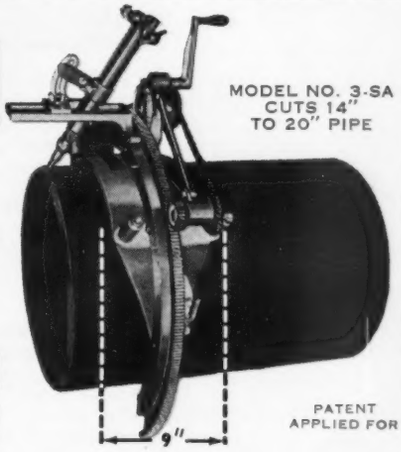
Electronic indicating control stations for 24-v. and 1-v. systems have been announced by Taylor Instrument Companies. New 701K series of control stations features large, full scale process indication, a complete manual power supply, and compact design for panel mounting. In addition, chassis may be partially removed from its case while still on control, permitting inspection or maintenance. Large 3-in. process meter and a 2-in. output meter are centered on the front panel for easy viewing. Calibration of both meters is based on 1-5 ma d-c. Multi-position switch permits either automatic or manual control modes, as well as providing for balancing of the controller's operational amplifier. Fourth position of the switch allows adjustments to be made which will give a bumpless transfer from automatic to manual control. **17**



New backfill blade for Parsons model 77 Trenchliners is available as optional equipment for new 77's or as an attachment for certain machines already in the field. Blade can be used for small backfilling jobs and to grade ahead of the trencher. It is 60-in. wide, 25-in. high and double acting through hydraulic cylinders. In raised position, the blade has 12-in. ground clearance. Quick attach and detach design is an important feature. It is attached with four pins — two in crawler frame and two in main frame. It can be detached in 15 minutes. Blade also has a removable cutting edge, ½-in. thick steel, connected to the blade with seven bolts. **18**

Computer programming system designed to reduce cost of preparing business data processing programs by as much as 50% is now available from Minneapolis-Honeywell's Electronic Data Processing division. The automatic programming aid, known as ARGUS (**A**utomatic **R**outine **G**enerating and **U**pdating **S**ystem), is designed to speed up the writing of data processing problems for the Honeywell 800 electronic computer. ARGUS reduces the time and effort required to code and check out EDP programs by enabling the computer itself to perform many clerical operations that on earlier machines were the responsibility of the manual programmer. **19**

NEW!



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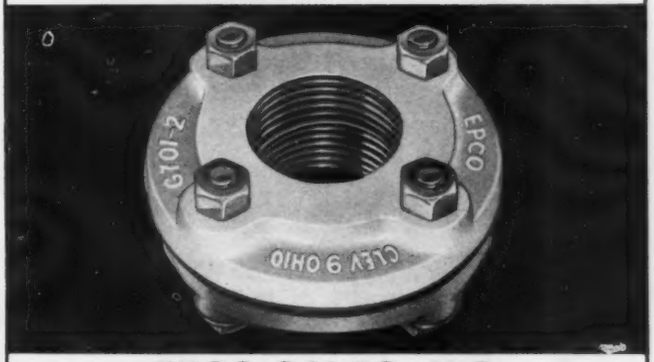

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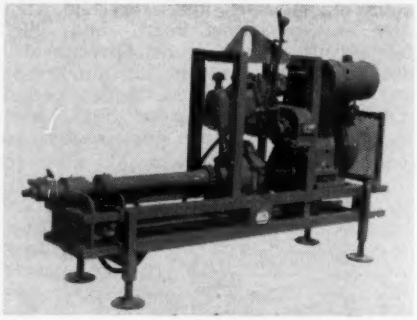
PRODUCT PARADE

New line of check valves especially suitable for use with large volume gas flow has been introduced by Clark Bros. Co., Div. of Dresser Industries, Inc. Designed to provide protection from system surge and backflow, the valves feature rapid, quiet response with efficient straight-through flow and low pressure drop. Are designed to be mounted horizontally, vertically, or any angle in a pipe or compressor discharge line. Valves are available for pressures up to 1000 psi with cast iron, cast steel, or alloy steel bodies in complete line of pipe sizes from 6 to 48-in. **20**

Advantages of simultaneous recording of four independent variables on one 4-pen electronic dynamaster recorder are discussed in new bulletin just issued by Bristol Company. **21**

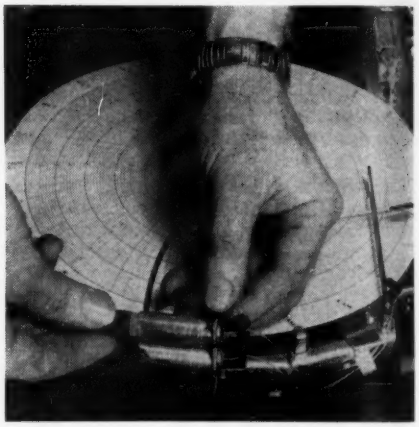
Small road boring machine for small diameter road boring jobs is now available from Crose-Perrault Equipment



Corp. Can be used to bore holes under streets, highways, and railroads. Only 76-in. long, 39-in. high and 20-in. wide, unit is easily transported in pick-up truck; weighs only 595 lb. Unit bores accurately; holes have been bored up to 75 ft with almost pin-point accuracy. A 7.5 hp gasoline engine, equipped with a kick starter, powers a drive shaft and the attached auger by means of a reversing transmission. Also supplies power for a centrifugal water pump that can force water thru hollow auger sections when machine is not boring thru sandy soil. **22**

Light weight aluminum gantry not only adjusts height, spread and level, but can be folded compactly and carried by two men. All aluminum unit "Magic-Pole" weighs only 186 lb and has a ¾-ton capacity. Unlike most rigid hoist supports, the Magic-Pole can be set up on the end of loading platforms and in pits, as well as in spaces with low head room and other crowded areas. Its telescoping legs have up to 6 ft of height adjustment, and are equipped with non-sparking swivel lock casters. **23**

New ink-cartridge meter marking device developed by Esterbrook Pen Co., uses



a capillary system drawing ink from a disposable cartridge, instead of the conventional manually-filled, open-bucket type system. Cartridge contains sufficient ink for up to several months of operation, eliminating the one, two, or three fillings a day or a week that may be required by open-bucket systems. New device is readily adaptable to all existing-type recorders — circular, strip, miniature and plotter. **24**

Compact, lightweight adjunct for mouth-to-mouth resuscitation, called the MSco Rescue Breather is now available from Medical Supply Company. Small enough to be carried in the rescuer's pocket, purse, auto compartment, or first aid kit, the MSco Rescue Breather features a flexible, tightly fitting facepiece that fits all faces and configurations, child or adul **25**

Latest welding development of Air Reduction Sales Company — Aircomatic Pipe Welder — is featured in new four-page brochure. The new automatic welder — using the Aircomatic (gas-metal-arc) CO/2 welding process — brings production speed to pipe welding without the need of pipe rotation. All phases of weld completion, from joint preparation to the finished weld, are accomplished by one simple set-up. **26**

Complete line of Cooper-Bessemer Corporation engine and motor driven compressors, power engines, expansion engines, industrial jet-powered gas turbines, and En-Tronic Control systems is presented in a new 14-page, four-color bulletin released by Cooper-Bessemer. **27**

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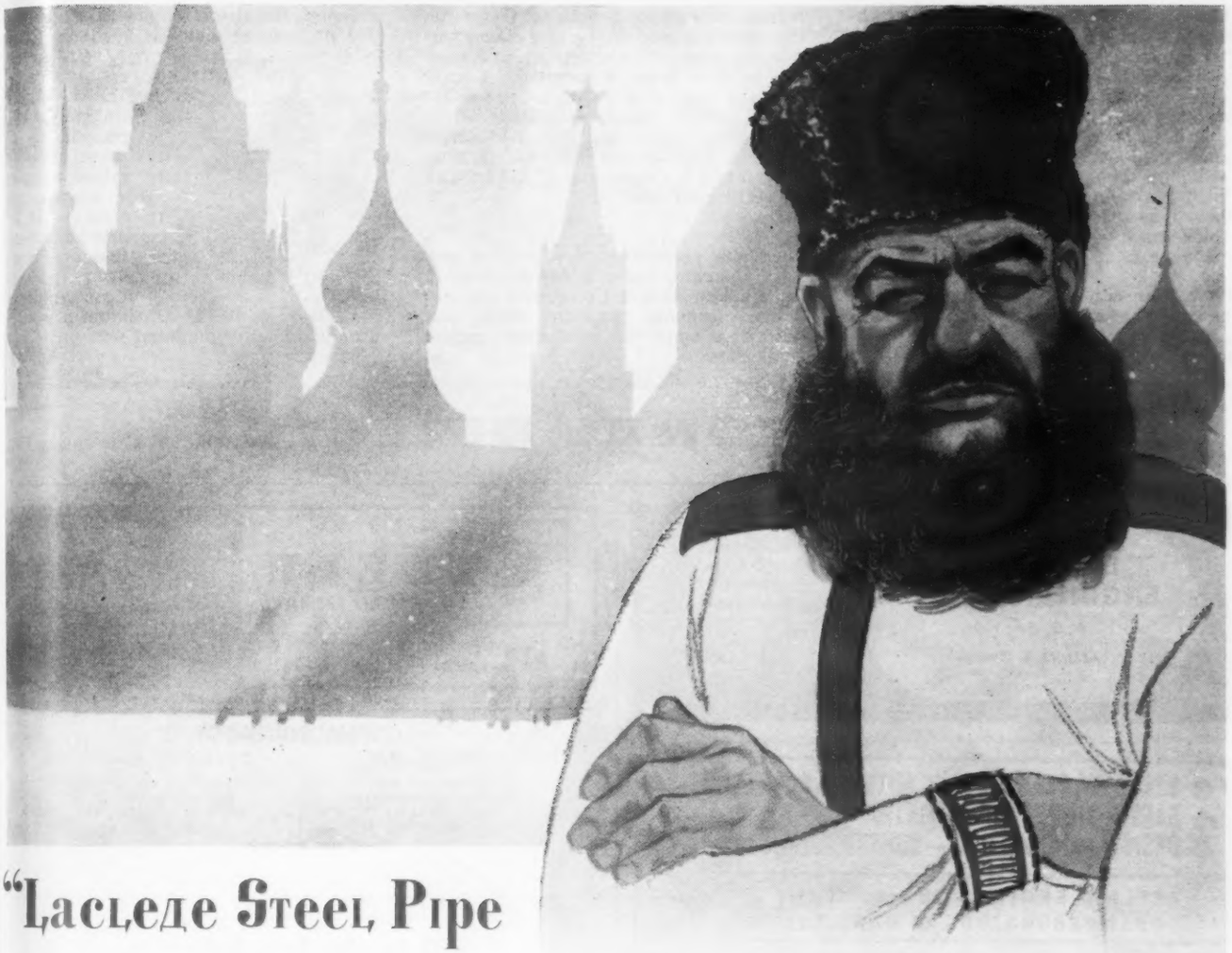

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PRODUCT PARADE

Parsons backhoe and Hydroclam attachments are now available for Huber-Warco "Maintainers." The complete line of Parsons backhoes, which includes 4 models, are now available as Maintainer attachments, along with the Hydroclam, available in three bucket width sizes. Parsons attachments will not in any way interfere with the Maintainer's other functions. Each backhoe or Hydroclam can be attached and detached in minutes: 4-pin quick-attach arrangement of the attachment makes it possible. **28**

New 2-ton crane. Ruger Equipment Inc. has announced a new series of 2-ton capacity mobile floor, truck, and pedestal-mounted hydraulic cranes. Said to be lighter, stronger, and more maneuverable than previous models, the new cranes permit one man to lift, transport, and position loads in a single operation. A hand pump in combination with a 2-speed hydraulic system, provides versatile lifting arrangement. Unit will still go through an 82-in. doorway but will now reach up to 10 ft and to a maximum 12 ft 3-in. with an extension boom. **29**

Pneumatic controllers. New bulletin uses block diagrams and cutaway drawings to explain how Bristol Company's advance design pneumatic controller works and how it is employed in various control applications. **30**

Pressure Regulator. A new extra sensitive pressure regulator is available from OPW - Jordan in either ductile iron or bronze in ¼, ⅜, ½ and ¾-in. sizes. Unit offers pressure regulation equal to piloted valves without trouble associated with pilots — it is completely self-operated. Pressure control range is from .5 to 125 psi. Suitable for 250 psi at 500 F. Maximum pressure drop is 175 psi; minimum pressure drop 3 psi. **31**

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